3rd Annual QUALITY CONTROL Feature Issue OCTOBER · 1950

TOOL & DIE JOURNAL

MAGAZINE OF

TOOLING & PRODUCTION

A-L TOOL STEELS

HERE'S *REAL* QUALITY CONTROL

DO YOU HAVE this HANDBOOK?

It's a 176-page book, "The Tool Steels of Allegheny Ludlum." It covers LXX, DBL-2, Super Panther, Deward, Saratoga, Huron, Ontario, Sagamore, Potomac, Pompton, Seminole, Utica, and other famous A-L grades. *Get your copy.*

ADDRESS DEPT. TD-10

That block or bar or rod of quality tool steel you received from Allegheny Ludlum . . . had to run the gamut of our vigilance committee right up to shipment time. You probably weren't here to watch the technically planned mill procedure, the laboratory controls, and the inspections—but you can quickly appreciate the value of our dozen or more quality safeguards, once the steel goes into service.

Consider, for example, the ultrasonic reflectoscope. It's uncanny how that ferrets out any internal flaw.

This daily ritual of checking, testing, and inspecting at the various stages of production insures sound, clean, tool and die steels—uniformly accurate in analysis, structure, hardness, etc.

ALLEGHENY LUDLUM
STEEL CORPORATION
Pittsburgh, Pa.

TOOL STEEL DIVISION: DUNKIRK, N. Y.

Fine Tool Steels Since 1854

W&D 3238

HERE'S AN ELECTRICALLY-CONTROLLED

AIR CYLINDER

WITH ALL CONTROLS BUILT-IN

The Bellows Model BEM Air Motor is a complete straight line power unit in itself. There are no extra valves to buy. The electrically-controlled Bellows Electroaire 4-way directional valve is an integral part of the cylinder. Bullet fast, shock free. The solenoid control units are unconditionally guaranteed against burnout. Low voltage assures safety to operator and machines. Works perfectly flooded with coolant or piled with grinder dust or chips. Built-in speed control valves provide full regulation of piston rod speed in either or both directions. No expensive piping to install. Unique construction requires only one air connection which can be made with flexible hose.

The Bellows Air Motor is made in 1¼", 1¾", 2½", 3⅜" and 4½" bores. Any stroke length.

Write today for Specification Bulletins and Case History Files. Address Dept. TDJ-1050

Write for Bulletin Today!

1156

The Bellows Co.
AKRON, OHIO
Offices in all Principal Cities

SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

TOOL & DIE JOURNAL

TOOLING AND PRODUCTION

1975 LEE ROAD
CLEVELAND 18, OHIO

CCA

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TOOL & DIE JOURNAL is published monthly for plant operating and purchasing executives and department heads in 50 types of end product and contract manufacturing companies.

Every copy is directed to such an individual by name, by title, and by company gratis. See CCA certification.

These men, from whom emanate recommendations, requisitions and orders for needed materials, tools, equipment and accessories, comprise the Cycles of Buying Influence within their respective plants—CBI—and it is they who constitute TOOL & DIE JOURNAL'S ever-vital reader circulation.

U.S. rate of subscription for schools, libraries and individuals other than above, $4.00 per year. Foreign subscription $5.00 per year. Single copy $.50.

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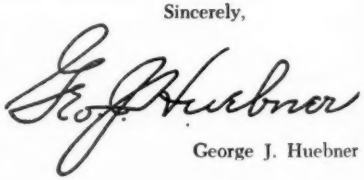
PUBLISHER'S MEMO:

Taft-Hartley Act has not hindered this union's progress—

In summarizing the last three years (which have been the first three years of the Taft-Hartley Act) David Dubinsky, president of the International Ladies' Garment Workers Union, said:

"Our union has added . . . nearly 50,000 to its membership rolls. It has become financially stronger in every affiliate and locality, and its prestige has grown in every market of our industry and over the entire nation . . . Our welfare government (paid vacations, medical and life insurance, pensions, etc.) has received in the past three years tremendous impetus, expanding its coverage to practically every affiliate of the union. This expansion was achieved strictly through negotiations, without recourse to economic dislocations.

Sincerely,



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NEW YORK 17, H. Thayer Heaton, 415 Lexington Ave., MUrray Hill 2-1647

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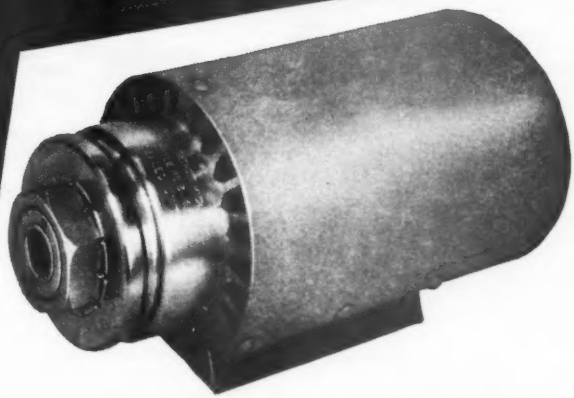
EX-CELL-O *Spindles*

"STEPPED UP PRODUCTION TREMENDOUSLY!"



That's what an electrical manufacturer says about a group of Ex-Cell-O Precision Spindles he purchased. These were of the high frequency, inbuilt motor type, pictured above. If you use precision grinding spindles send for the Ex-Cell-O Spindle Catalog today—no obligation of course. For a quotation on special spindles just send a sketch with basic dimensions and state the speed and horsepower required.

XLO

EX-CELL-O for PRECISION

EX-CELL-O

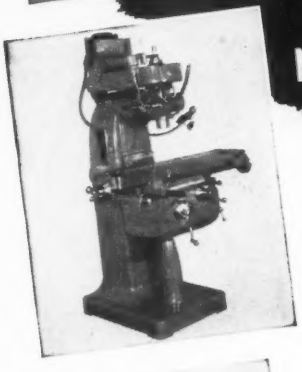
CORPORATION

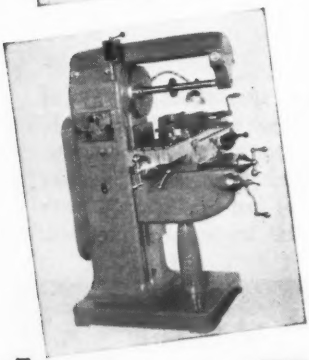
DETROIT 32, MICHIGAN

30-5

SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

EXTRA CAPACITY and VERSATILITY are definite advantages of INDEX Milling Machines





IDEAL FOR THE TOOL ROOM— EXCELLENT FOR LIGHT PRODUCTION

Model 55 IMPROVED VERTICAL MILL. A speed range of 80 to 2700 RPM's combines with a 1 H.P drive, 3¼" quill, and extra rugged spindle mounted on over-size precision ball bearings to give a capacity of ⅛" to 1½" end mills in steel. Spindle quill travel is 5¼" either by lever, hand wheel, or power, and has adjustable positive stop and automatic safety throw-out. Table 40" x 9" or larger. Longitudinal table power feed has 8 geared feed changes.

Model 60 PLAIN HORIZONTAL MILL. A full No. 1, that in many ways equals or exceeds a light No. 2 in capacity. Low maintenance due to all rapid moving parts running in oil, hardened alloy gear train, and fully ground alloy steel spindle mounted on pre-loaded precision ball bearings requiring no adjustment. Standard table 40" x 9" overall, with larger table optional, is supported by 18" of saddle bearing, and has accurately ground lead screws for transverse and longitudinal movement. Constant flow coolant system of 8 gallon capacity starts and stops with spindle.

Write for Literature

INDEX MACHINE CO.

541 N. MECHANIC STREET JACKSON, MICHIGAN

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

One RECESSING TOOL... *Any* RECESSING JOB!

● Cut Recessing Costs on your Drill Press . . . Boring Mill . . . Turret Lathe . . . Radial Drill . . . etc. **ALL NEW** Series "R" Maxwell Recessing Tools give unlimited versatility.

SIX sizes are stocked for immediate shipment. Shanks to fit your machines are instantly interchangeable. Capable of taking cuts at extremely high rates of feed, the new Maxwell tools feature a micro-adjusting collar which facilitates rapid and accurate diameter control to within 0.001-inch or 0.050-inch per tool revolution. Cutters can be supplied to make single or multiple recessing in a single operation.

Cut location made from either top or bottom surfaces. Ball-bearing pilot facilitates use of Series "R" Recessing Tools with existing fixtures. Without fixtures, ball-bearing pilots will stop on workpiece surface to accurately locate cutter.

Hardened tool-steel wearing surfaces guarantee maximum tool life. Cutting action is smooth and requires only finger-tip feed pressure. Series "R" Recessing tools are regularly furnished having cutter ratio of either 1:3 or 1:1. Hole in tool block permits flow of coolant or lubricant to cutter.

Standard Series "R" Recessing Tools are available to cut recesses from ¼ to 4¼ inches in diameter. Write today for catalog "R" . . . .

Precision boring with MASTUR heads is described in catalog PBH. These inexpensive tools feature large capacity, adjustability and accuracy. Specifications are charted.

Production Boring with the E-Z set line of Boring heads is subject of catalog No. 30. Complete line of tools is shown. Prices, capacities and specifications are charted for reference.

THE MAXWELL COMPANY

227 BROADWAY **BEDFORD, OHIO**

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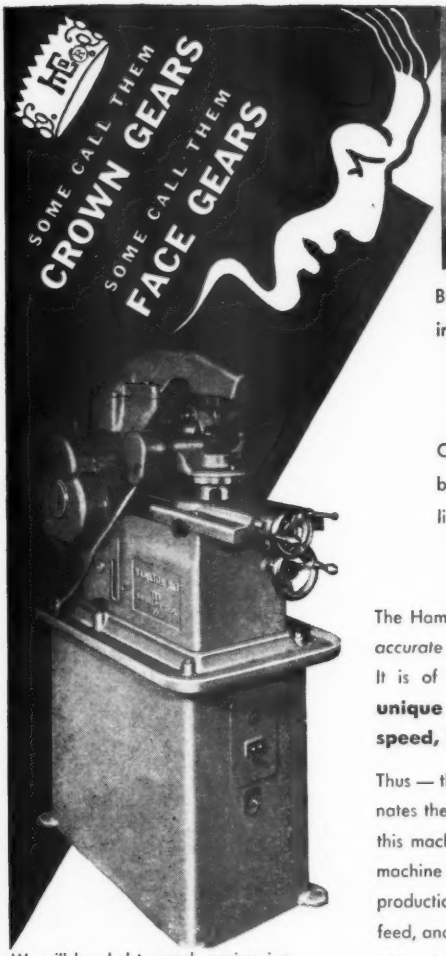

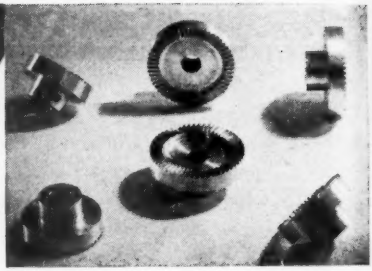

But all gear manufacturers agree that accuracy in a gear of this type is most difficult to achieve.

THE HAMILTON NO. 1 PRECISION GEAR HOBBER ACHIEVES ACCURACY

CROWN GEARS, formed on this machine, will be found to have perfect contact on the pitch line throughout the entire length of the tooth.

FILE THESE FACTS IN YOUR MEMORY

The Hamilton No. 1 Gear Hobber forms *small, super-accurate* spur, spiral, bevel, worm, and face gears. It is of extra rigid construction, and embodies the **unique feature of independent selection of speed, feed, and indexing.**

Thus — the principle of this machine (hobbing) eliminates the possibility of indexing error. The accuracy of this machine is reckoned to .0002". The rigidity of this machine *maintains* accuracy and encourages heavy production loads. The principle of independent speed, feed, and indexing selection, embodied in this machine, cuts set-up time far below previously acknowledged minimums, and permits higher production on relatively soft materials without indexing change.

We will be glad to supply engineering information about the application of the Hamilton No. 1 machine to your particular job. **Also ask for our Bulletin H 1-49. It illustrates and explains the Hamilton No. 1 Gear Hobber in detail.**

DEALERSHIPS are still available in eight territories. Write for information.

THE *Hamilton* TOOL COMPANY
832 SO. NINTH STREET • HAMILTON • OHIO • U • S • A

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From the DUMORE Archives

and, after all, we've been at it over 35 years

"That price rise in meat means poor Nick has to go!"

You can't afford INEFFICIENCY ...even if it's FREE!

"Who would be stupid enough to use a Neanderthal man with his bow drill in a modern shop?"

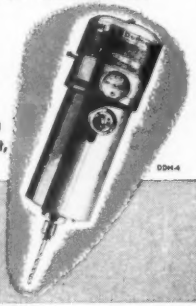
Wait a minute mister! Maybe it's not so far fetched. Let's take a look at *your* small drill operations.

If you're drilling manually with No. 80 to ⅛" drills, you're losing money even if you've written off the presses.

With Dumore Automatic Drill Heads you can use low-scale workers and still get more production, cut drill breakage, cut scrap loss. On many installations, drill savings alone pay for the Dumore head the first year.

Make us prove these claims. Write today for free 16-page bulletin on the New Dumore Automatic Drill Head.

THE DUMORE COMPANY
Dept. K-42 Racine, Wisconsin
Export Address: 13 East 40th Street, New York 16, N. Y., U.S.A.



Everywhere—hats are off to the SIZE-MARK on PARKER-KALON Socket Head Cap Screws

TOOL CRIB BOSSES
welcome it because sorting is made so much easier and quicker . . . a glance at the head of a P-K Screw immediately tells you its size.

ASSEMBLY WORKERS
are all for it because sizes are always issued correctly. The Size-Mark prevents delays, helps them make better time on the job.

APPRENTICES
cheer the Size-Mark on P-K Screws because it protects them from errors . . . enables them to learn sizes faster and do a better job.

SALES MANAGERS, TOO
hail the Size-Mark on P-K Screws. It's a definite sales advantage because it saves time for customers' service men in reassembly.

And the GEAR GRIP† prevents *slipping* — even when fingers are oily! Send for samples . . . see for yourself how P-K* Size-Marked Socket Head Cap Screws can put your product ahead, assembly-wise and sales-wise. Parker-Kalon Corporation, 200 Varick Street, New York 14, N. Y.

NEW . . . . . Size-marked Engineered Hex Keys

Key size, and corresponding socket set and cap screw sizes, are clearly stamped on the arm of Parker-Kalon Engineered Hex Keys. P-K Hex Keys are again available in attractive, compact steel cases with easy-to-use key island (Set No. 111), and in durable plastic pouches (Set No. 45).

PARKER-KALON* *cold-forged* SOCKET SCREWS

SIZE-MARKED SOCKET HEAD CAP SCREWS • GROUND THREAD SOCKET SET SCREWS • FLAT HEAD SOCKET CAP SCREWS
STRIPPER BOLTS • PIPE PLUGS • HEX KEYS • AVAILABLE EVERYWHERE THROUGH ACCREDITED DISTRIBUTORS

*TRADE MARKS REG. U.S. PAT. OFF. †U.S. DESIGN PAT. NO. 120,409

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

NEW 14"
South Bend
Economy Model
DRILL PRESS

$76.00 f.o.b. factory less motor and chuck

RUGGEDLY CONSTRUCTED FOR MACHINE SHOP SERVICE

Write for Bulletin 402

Features include automatic belt tension, direct reading depth stop, full tilting table, rigid one-piece head casting, free-floating six-spline spindle, four pre-lubricated and sealed precision ball bearings, and adjustable quill feed tension.

Specifications: Drills to center of 14-1/4" circle, maximum drill size 1/2" in steel, spindle run out .005" or less, spindle square to table within .0075" in 5". Net weight of bench model shown; less motor, wiring and drill chuck is 124 lbs.

SOUTH BEND LATHE
SOUTH BEND 22, INDIANA
Building Better Tools Since 1906

SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

the new DETROIT NUT DRIVER

Never Before

Anything Like It

Again the Detroit Power Screwdriver Company leads the way. Having whipped the problem of production screwdriving by replacing slow hand methods with magazine-fed power-driven screwdrivers, it now breaks another bottle-neck by the introduction of this new machine that will drive nuts with amazing speed, either semi-automatically, or it can be adapted to full automatic operation, entirely eliminating the manual handling of nuts except to load the hopper which feeds the nuts to the driving spindle. Capacity: Nuts, ¼" min. to 7/16" max. across flats . . . Will drive any nut within its range that can be selected and fed in a uniform position. Get our catalog, describing this new Nut Driver, also Power Screwdrivers, Motorized Hoppers and Special Assembling Machines. SEND SAMPLE ASSEMBLY FOR PRODUCTION ESTIMATE.

DETROIT POWER SCREWDRIVER CO.
2827 WEST FORT ST., DETROIT 16, MICHIGAN
Yes, send along your new catalog . . . sounds interesting.

COMPANY NAME_____
BY_____
STREET ADDRESS_____
CITY_____ STATE_____

DETROIT POWER SCREWDRIVER CO.
2827 WEST FORT ST. DETROIT 16, MICHIGAN

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

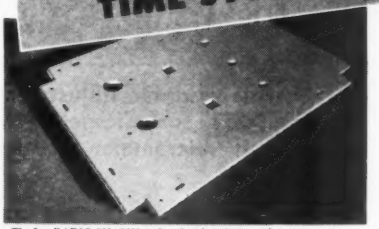
An on-the-spot demonstration of the Wales Sheet Metal Fabricator on a mobile trailer hitched to a station wagon.

Showing a finished part that has been time studied. This scene can be duplicated in your plant . . . without obligation.

Now you can check . . .

WALES Fabricator

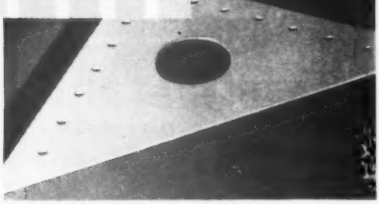
TIME STUDIES IN YOUR OWN PLANT!



The first RADIO CHASSIS, 10"x14" with 27 holes and 4 notches shown above was produced including setup in only 9.3 minutes and subsequent pieces in only... **1.8 min.**

An ELECTRIC REFRIGERATOR part 39½"x8½" with 10 holes and 4 notches was fabricated including setup in only 5.61 minutes and subsequent pieces in only.... **37 sec.**

An AUTOMOTIVE channel, 28" long with 12 holes was fabricated including setup in only 5.37 minutes and subsequent pieces in only ..... **29 sec.**



An AIRCRAFT gusset plate 7½" x 4½" with 15 holes and 1 notch was produced including setup in only 3.52 minutes and subsequent pieces in only..... **54 sec.**

● The time studies at left and below are typical of the cost savings made possible by Wales Fabricators.

There is nothing like this revolutionary Wales Fabricator. It punches, notches and nibbles. Wales exclusive Hydra-New-Matic Drive is unique in its simplicity of design and operation . . . so unique, in fact, the vibration and noise is practically eliminated at 165 strokes a minute. This drive, plus Wales patented "Quick-Change" System makes possible startling "never-heard-of-before" time study figures.

If the time studies seem so phenomenal to you that you want to see for yourself (as shown in top pictures) ask for a demonstration at your own plant on your own parts by writing TODAY—

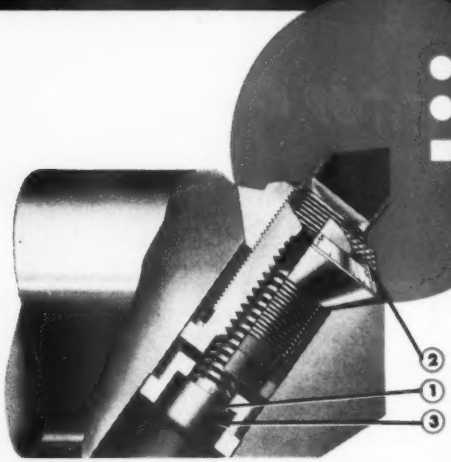
WALES-STRIPPIT CORPORATION
GEORGE F. WALES, *Chairman*
355 PAYNE AVENUE, NORTH TONAWANDA, N. Y.
(Between Buffalo and Niagara Falls)
WALES-STRIPPIT OF CANADA, LTD., HAMILTON, ONTARIO

Specialists in Punching and Notching Equipment

MICROBORE
by DeVlieg

Reduces Set-up Time

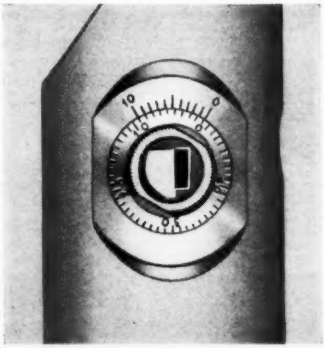
BY ELIMINATING CUT AND TRY METHODS OF TOOL ADJUSTMENT



Fast dependable adjustment to .0001" on diameter by proven micrometer Vernier principle.

METHOD OF ADJUSTMENT

1. Loosen lock screw
2. Adjust graduated dial
3. Tighten lock screw



ILLUSTRATED CATALOGUE MAILED ON REQUEST

Send us your boring and turning problems

DeVLIEG MICROBORE COMPANY

400 FAIR AVENUE • FERNDALE 20, MICHIGAN, U.S.A.

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

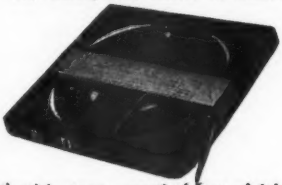
Specify ATLANTIC

BAND SAW BLADES

for Smoother

CONTOUR CUTTING

ATLANTIC SAWS meet all of your requirements for a superior blade on complicated die and fixture radius cutting. ATLANTIC specializes in accurate milled and precision set teeth, hardened to exact temper.



Atlantic's strong, practical box, plainly marked on sides and top. Remains in good condition until entire coil is used.

ATLANTIC'S special alloy steel insures longer wear and easier welding.

ATLANTIC'S one temper saw for all metals reduces stock you have to carry. Cut to length and welded, ready for use. Packed in strong Atlantic box. Write for new Atlantic Catalog.

Atlantic Saw Mfg. Co.

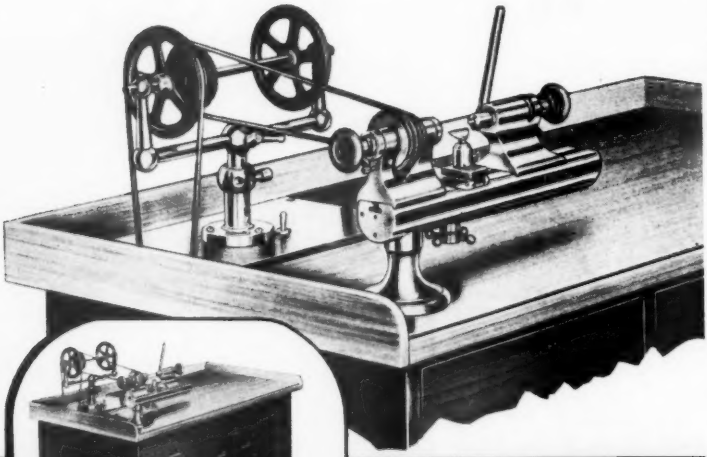
INCORPORATED

Exclusively Manufacturers of Band Saw Blades

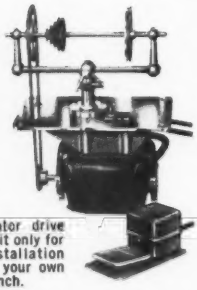
160 Brewery St., New Haven, Conn.

SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

PRECISION LATHES and ACCESSORIES for SMALL WORK



Lathe with complete bench and motor drive.



Motor drive unit only for installation in your own bench.

LEVIN

AMERICA'S FINEST PRECISION JEWELER'S LATHES

Widely acclaimed as ideal for instrument work, second operations for production, tool work or experimental work and model making. Collet capacity 3/16" or 5/16".

Available with motor drive and bench or for separate mounting. Send for complete catalog and prices of lathes and accessories.

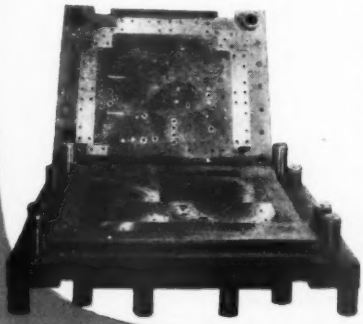
LOUIS LEVIN & SON, INC.
782 East Pico Blvd.
Los Angeles 21, Calif.

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

Big Dies Cut Costs in Television Chassis Production!

Dies are a vital factor in television chassis production, handling 1/8 inch thick blanks of strip steel over 500 square inches in area . . . and they represent an important investment! Hundreds of hours of costly, painstaking die work are required to produce each one. Such an important investment must be protected. That's why they built their dies in

DANLY PRECISION DIE SETS



Danly precision makes every Danly Die Set a reliable base for the finest die work . . . assures the greatest possible protection for a big die investment. Precision closure protects die components to assure longer production runs. And they save time in the die shop, too, because they're square and true.

Standard Danly Die Sets are quickly available from a nationwide system of completely stocked assembly branches. Just phone for fast delivery . . . and for the finest in die set precision, always specify Danly!

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Ave., Chicago 50, Illinois

PRECISION DIE SETS . . . STANDARD AND SPECIAL

WHICH DANLY BRANCH IS CLOSEST TO YOU?

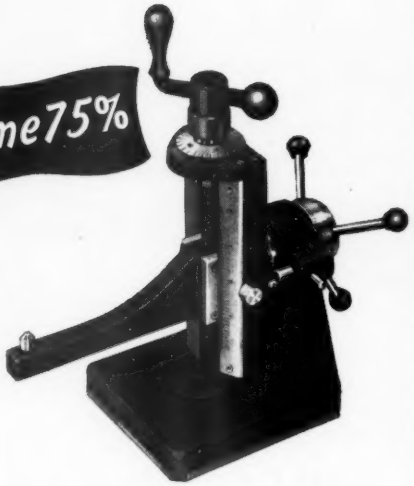
DANLY®

Cut Set-Up Time 75%

WITH

DIRECT READING

RADIUS DRESSER



It's easy! The Perfex Radius Dresser is as simple to set as a "mike." Hardened and ground micrometer screw permits precision setting throughout the full range – from 2" convex to 2" concave. Take reading *directly* from micrometer head – *eliminate* height gauges, "mikes" and errors – *gain* simplicity, accuracy, hours of time. Simple as A B C; set your diamond to Master Setting Block furnished – then operate same as micrometer.

The Perfex Radius Dresser will dress concave radii smaller than .050" — *full 180°*. Dressing head is graduated each 5°, equipped with stop dogs to permit dressing within given arc. One revolution of mike screw moves diamond .025", providing rapid adjustment. It's a *precision* instrument, manufactured by gage makers mindful of tool-makers' requirements. Durable carrying case with Master Setting Gage and provision for our standard diamond tool and attachment for small concave radii.

$149.00 complete with hardwood case and attachments.

In addition to the Radius Dresser Perfex builds an *Angle Tangent to Radius Dresser*

BRING YOUR WHEEL DRESSING PROBLEMS TO PERFEX

Perfex GAGE AND TOOL CO.

123 AVERY STREET • MT. CLEMENS, MICH.

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U. S. AUTOMATIC STOCK REEL

reel at left of illustration.) AR-1 Automatic Stock Reel arranged for unwinding. Capacity: material up to 5¼ inches in width and 400 pound coils. Equipped with mercury switch control and motor. This type reel made in a range of sizes.

U. S. STOCK OILER AND WIPER

U. S. Combination Stock Oiler and Wiper suitable for material 8 inches in width. Also made in a larger size for material up to 12 inches in width.

U. S. PLAIN STOCK STRAIGHTENER

SS-O U. S. Plain Stock Straightener, five-roll type, suitable for material up to 2½ inches in width. This type straightener made in a wide range of sizes in 5, 7 and 9-roll types to accommodate material of varying widths and thicknesses.

U. S. SLIDE FEED

SF-1 Slide Feed suitable for material 2½ inches in width and feed length adjustable up to a maximum of 4 inches. U. S. Slide Feeds made in a range of sizes to accommodate material of different widths and to provide a range of feed lengths.

U. S. AUTOMATIC STOCK REEL

AR-1 Automatic Stock Reel arranged for rewinding. Capacity: material 5¼ inches in width and 400 pound coils. Equipped with mercury switch control and motor. This type reel made in a range of sizes.

AUTOMATIC operation with resultant lowering of production costs is the aim of all manufacturing concerns.

In connection with press work, a definite step toward the attainment of automatic operations can be made through the use of U. S. Automatic Press Room Equipment. The illustration above shows an automatic setup consisting of U. S. Slide Feed, U. S. Plain Stock Straightener, U. S. Stock Oiler and Wiper and two U. S. Automatic Stock Reels (one for unwinding and one for rewinding.)

Investigate the advantages of U. S. Automatic Press Room Equipment. Ask for a copy of Bulletin No. 70-T containing complete specifications.

U. S. TOOL COMPANY, Inc.

Ampere (East Orange) New Jersey

Builders of U. S. Multi-Slides—U. S. Multi-Millers—U. S. Automatic Press Room Equipment—U.S. Die Sets and Accessories

New

DICKERMAN 9-INCH ROL-DI-FEED

Revolutionary Automatic Punch Press Feed!

A COMPACT SELF-CONTAINED CAM DRIVEN FEED

GENERAL SPECIFICATIONS

CAPACITY

Handles coiled or short strip up to 3/16" thick and any width developed for a given thickness of stock where weight of stock does not exceed 2 pounds per linear foot.

MAXIMUM FEED LENGTH

9" on presses having 3" or more of stroke and approximately three times the stroke for strokes under 3". Feed length adjustable in increments of .001".

MOUNTING SPACE REQUIRED

For Feed — 3" x 9" Wide
For Cam — 2" x 2¾" Wide

PHYSICAL DIMENSIONS

Length Overall — 22"
Width Overall — 12"
Height Overall — 7"
Shipping Wgt. — 100 lbs

This New Revolutionary Dickerman Rol-Di-Feed is a compact, self-contained Cam Driven Feed which can be easily installed on press bolster or directly into some die shoes to feed stock in any desired direction.

It will feed metal, fibre, paper, mica, plastic, etc., in unlimited range of width, from continuous coils or short lengths. Provides increased range and versatility seldom found in larger, more costly feeds.

Install this New Dickerman Rol-Di-Feed for simplicity, adaptability, economy and feeding accuracy. Write for detailed information and price.

H. E. DICKERMAN MANUFACTURING COMPANY

323-1019 ALBANY STREET • SPRINGFIELD, MASS.

SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

LEPEL offers a New LOW COST High Frequency HEATING UNIT

AT A PRICE SO LOW THAT NO MACHINE SHOP, TOOL ROOM OR LABORATORY CAN AFFORD TO BE WITHOUT IT!

DOES ALL THESE JOBS *Faster, Better and Cheaper*
BRAZING, SOLDERING
HARDENING, ANNEALING
DRAWING AND
MELTING

- **SMALL and COMPACT**
  Conveniently operated on bench or table — no mounting necessary.
- **ECONOMICAL OPERATION**
  No special power installation required. Operates on 110 volts, 60 or 50 cycle line at unity power factor.
- **FULLY GUARANTEED**
  Guaranteed for continuous duty cycle and stated performance.
- **LOW COST** $780
  Complete unit with line connection and load coil f.o.b. factory

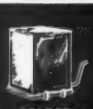
Unit illustrated brazing carbide tips to cutting tools. Shanks up to 1½" square can be satisfactorily brazed.

WILL HEAT TO 1500° F.

⅛" steel rod 1" length in approx.	1 second
¼" " " " " "	3 seconds
½" " " " " "	15 seconds
1" " " " " "	60 seconds

Will melt 4 ounces of brass or steel in 4 minutes.
Equally well suited for heating of non-ferrous metals.

HARDEN


SOLDER

Lepel
HIGH FREQUENCY HEATING UNITS

BRAZE

MELT

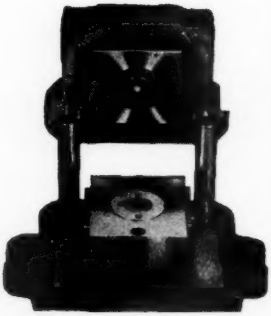
LEPEL HIGH FREQUENCY LABORATORIES, Inc., 39 West 60th Street, New York 23, N. Y.

Write for Lepel Catlog TD-10

A MUST wherever WASHERS are made!

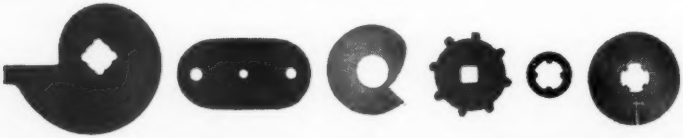
HOVIS OFFERS YOU THIS SIMPLE, UP-TO-THE-MINUTE METHOD

There's no need to make a complete new Die for any type washer or blank. The HOVIS UNIVERSAL WASHER DIES provide a Master Holder and by merely changing 5 SMALL, EASILY REMOVABLE PARTS the new washer or blank is produced . . . Special sets of parts are available for use in Master Washer Units enabling customers to produce irregularly shaped pieces and shallow draws. Multi-Washer Dies are also designed and manufactured.



Made in 5 sizes:
¾"—1½"—2½"—4"—6".

Write for literature.



HOVIS SCREWLOCK COMPANY

8100 E. NINE MILE ROAD — **Phone: Slocum 7-1334**

VAN DYKE, MICHIGAN — **Suburb of Detroit**

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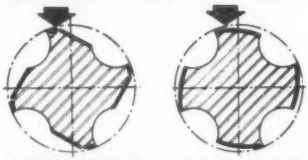
PROVED!

Radial Relief Grinding gives up to 500% greater tool LIFE as result of better support at cutting edge



ANGULAR RELIEF RADIAL RELIEF

Available in hand operated and motor driven models for tool room or production use.

Now, D.S. has simplified Radial Relief grinding. Made it a job for any good grinder hand by eliminating complicated set-up and computations. Grinds taps, center drills, reamers, counterbores, etc., one to 14 flutes.

D. S. GRINDER DIVISION
ROYAL OAK TOOL & MACHINE CO.
621E Fourth St., Royal Oak, Mich.

Gentlemen:

Please forward your D. S. Catalog.

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The UNBRAKO Socket Head Cap Screw

...is specified by designers and production men everywhere because of its *time-saving* knurled head and its uniformly high quality.

See us at Booth 2434, Convention of National Metal Congress and Exhibition, Chicago, October 23-27.

Knurled Head Socket Cap Screws
Flat Head Socket Cap Screws
Self-Locking Socket Set Screws

SOCKET **UNBRAKO** SCREWS

Knurled Head Stripper Bolts
Precision-Ground Dowel Pins
Fully-Formed Pressure Plugs

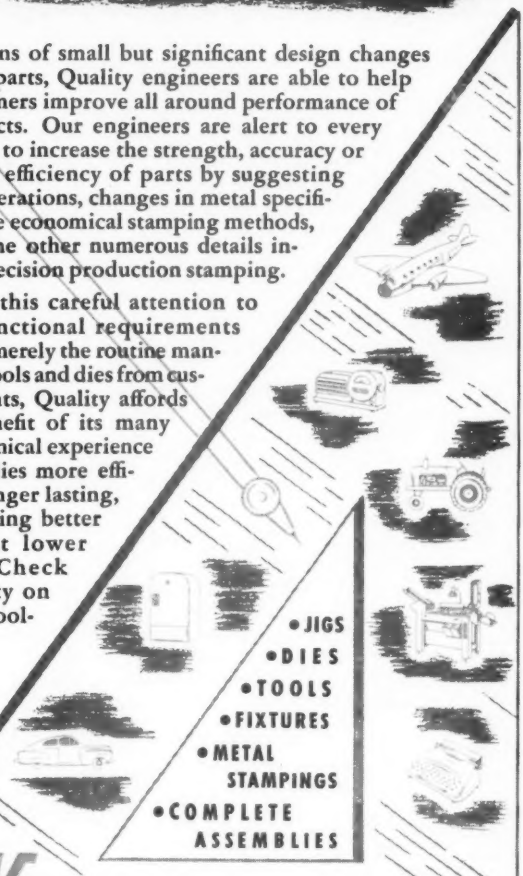
SPS STANDARD PRESSED STEEL CO.

JENKINTOWN 36, PENNSYLVANIA

How QUALITY'S Engineering Skill helps to improve your product

BY means of small but significant design changes of integral parts, Quality engineers are able to help many customers improve all around performance of their products. Our engineers are alert to every opportunity to increase the strength, accuracy or operational efficiency of parts by suggesting small die alterations, changes in metal specifications, more economical stamping methods, or any of the other numerous details involved in precision production stamping.

Because of this careful attention to study of functional requirements rather than merely the routine manufacture of tools and dies from customer's prints, Quality affords you the benefit of its many years of technical experience in making dies more efficient and longer lasting, thus producing better products at lower unit cost. Check with Quality on your next tooling job!



- JIGS
- DIES
- TOOLS
- FIXTURES
- METAL STAMPINGS
- COMPLETE ASSEMBLIES

QUALITY HARDWARE AND MACHINE DIV.

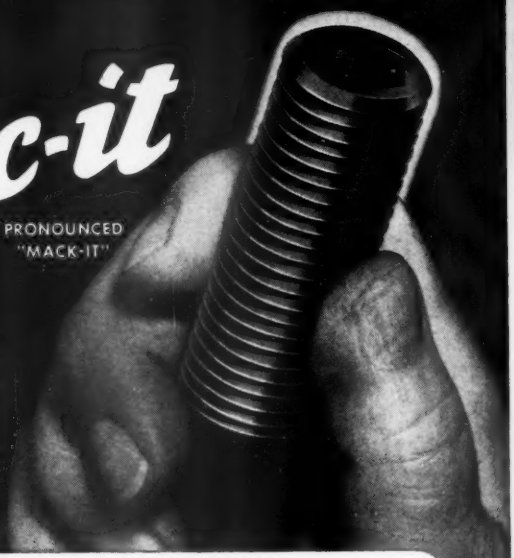
Continental Copper and Steel Industries

5847 North Ravenswood Ave. • Chicago 26, Illinois

IT'S A

Mac-it

PRONOUNCED "MACK-IT"



Mac-it ⅝" x 2½" Hollow Set Screws have grip of more than 17,000 pounds.

BETTER, FASTER SERVICE WITH THIS *Complete* MAC-IT LINE!

Because many standard types of Mac-its are stocked throughout the country for quick delivery, and because specials can be engineered to your own specifications, you'll find it pays to investigate Mac-its *first.*

Mac-it's 35 years' experience in the manufacture of heat-treated, alloy steel screws is your assurance of precision, uniformity and strength. Sold through leading industrial distributors from coast to coast and in Canada. Write for new catalog today!

Other Mac-it products include:

Hollow Lock Screws	Socket Screw Keys
Socket Head Cap Screws	Square Head Set Screws
Stripper Bolts	Hexagon Head Cap Screws
Hollow Pipe Plugs	. . . and many others

Marketed Nationally Since 1913 by

STRONG, CARLISLE & HAMMOND COMPANY

Cleveland 13, Ohio

Manufactured by MAC-IT PARTS COMPANY, Lancaster, Pa.

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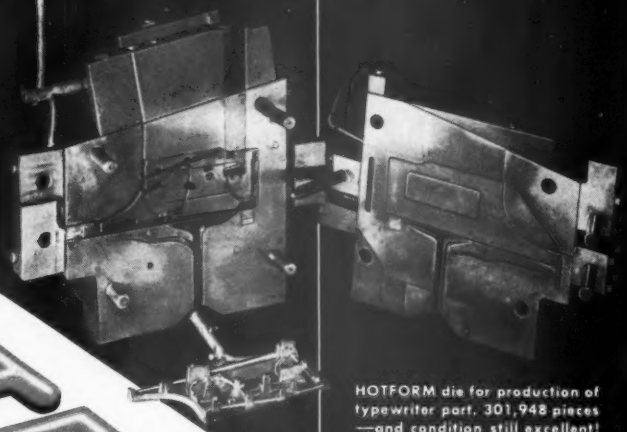
Light Metals Die Casting



HOTFORM die for production of typewriter part, 301,948 pieces —and condition still excellent!

HOTFORM

Hotform is designed, by chemistry and fabrication, to overcome the troubles encountered in building die casting dies. If you have experienced poor machinability (perhaps pins do not fit easily in reamed holes)—or if movement in hardening has been a problem—or if you have had die failures due to cracks and breakage from thermal or mechanical shock—USE HOTFORM!

Strong and tough at elevated temperatures, Hotform is carefully annealed and inspected, supersonically tested in large sizes. Hotform is available from stock in all die casting die sizes, and also in drill rod form for pins, guides, cores, etc. Our representatives will gladly assist you with the application and heat treatment of Hotform for your work.

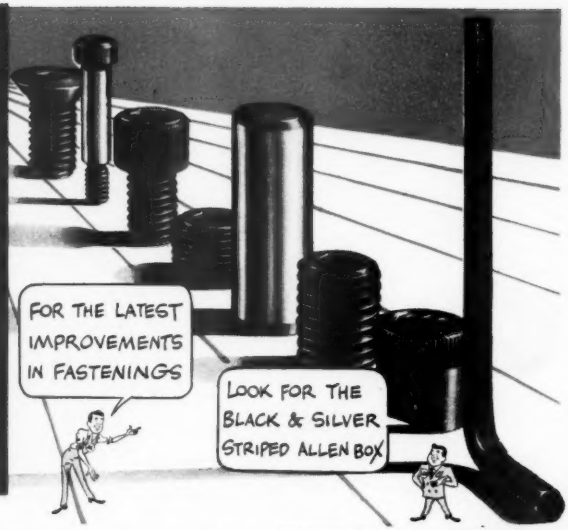
Vanadium-Alloys
STEEL COMPANY
Latrobe, Penna.

COLUMBIA STEEL DIVISION · ANCHOR DRAWN STEEL CO.

Manufacturers of
FIRST QUALITY
TOOL AND DIE STEELS
exclusively . . .

You're ahead of the parade with..

ALLEN ⬡ HEAD SCREWS



New manufacturing methods and improved alloys are constantly bettering the quality and uniformity of socket screws, dowel pins and pipe plugs.

Not all the improvements are made first by Allen but *a very large percentage of them are.* Some of the most important have yet to be duplicated even after years of trying.

If You Buy Socket Screws, Dowel Pins or Pipe Plugs, standardize on genuine Allen products to get more important improvements sooner.

If You Are Designing or Improving a Product, check with Allen directly or through your industrial distributor. Frequently a long search for more satisfactory fastenings ends in the Allen engineering department.

SOLD ONLY THROUGH LEADING DISTRIBUTORS. Write the factory direct for technical information and descriptive literature.

Ask Raytheon:

Allen ⬡ Head screws are required to meet the standards of most of the Raytheon products manufactured on Government contracts; hence they are used widely on the equipment made by this prominent manufacturer.

WARNING
Allen-Type screws aren't necessarily Allen-Made. Get genuine "Pressur-Formed" Allen ⬡ Head screws in this black and silver box.

ALLEN

ALLEN HEAD

MANUFACTURING COMPANY

Hartford 2, Connecticut, U. S. A.

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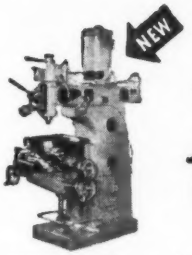
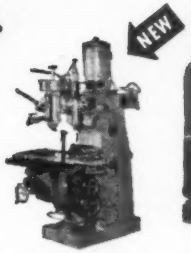
GORTON TRACER-CONTROLLED MACHINE TOOLS and Accessories

Send for your copy today. Gorton tracer-controlled milling embodies distinct advantages on the production line and in the tool room. In many cases, special tooling will make a given operation entirely automatic. Send for the Gorton General Catalog illustrated above or for any of the other specialized bulletins described below published for your information and reference.



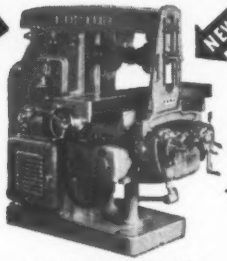
NEW

0-16A VERTICAL
Incorporates all of the desirable features of former 8-D. Also available with swivel or universal head. Bulletin 2240.



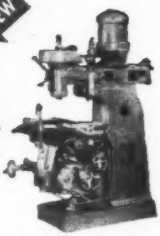
NEW

0-16A DUPLICATOR
Rugged, versatile and extra sensitive for exacting die and mold work. Also available with swivel or universal head. Bulletin 1319.



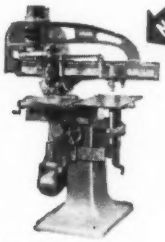
NEW

2-28B HEAVY HORIZONTAL
No. 2 Heavy, No. 3 Medium in plain, universal, vertical models. Spindle speeds to 2,000 r.p.m. Full width knee provides maximum rigidity. Request Bulletin 2321 for No. 2 size or 2407 for No. 3.



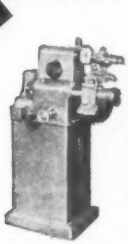
9-J DUPLICATOR
Rugged in construction; has *Gorton super-speed spindle and sensitive controls for the most exacting work. Bulletin 1319.

3-U PANTOGRAPH
Sturdy and rigid with sensitive tracer control. Larger and heavier 3-Z model also available. Bulletin 1580.



NEW

PI3 PANTOGRAPH
†Ratiobar Pantograph for 3-dimensional work. First basic design improvement in pantograph construction. Bulletin 2310.



375-2 CUTTER GRINDER
Universal type; bench or floor models; capacity up to ⅝" dia., including ball nose and multi-flute cutters. Bulletin 1317.

16-B AUTOMATIC LATHE
For precision turning of long slender parts from .005" dia., by 1/32" long to ⅞" dia., by 2¾" long. Bulletin 1800.

*Trade Mark Reg. U. S. Pat. Office

†Pats. Applied For

GEORGE GORTON MACHINE CO.
1210 Racine St., Racine, Wis., U. S. A.

Please Send at Once

For brief facts about the Gorton line of tracer-controlled machines, use coupon or company letterhead and request Bulletin 1655-1210 illustrated above. For specific information on certain machines, see text accompanying each illustration.

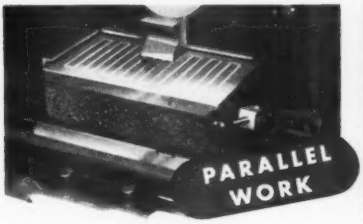
Name.....

Title.....

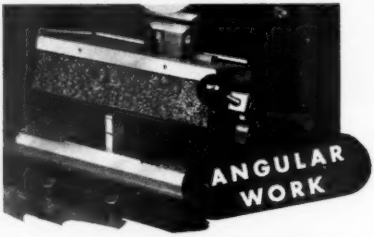
Address.....State.....

SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

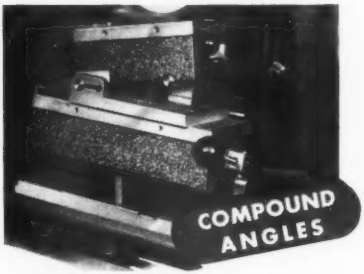
The MAGNA-SINE is more versatile than any other magnetic chuck



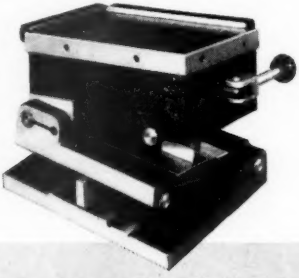
The Magna-Sine, when closed, serves as a conventional magnetic chuck for surface grinders. The chuck is permanent-magnet type and built to precision tolerances. Suitable for either wet or dry grinding.



When an angular job comes along, the Magna-Sine is accurately set up by inserting standard gauge blocks. The proper blocks are indicated in the Table of Constants furnished with each unit. Think of the saving: angular set-ups—*to gauge block accuracy*—made in a matter of minutes with the Magna-Sine.



For compound angular work, add another single angle Magna-Sine.* The additional unit may be held securely by the magnetic chuck of the first unit. Any desired compound angle can be set up fast and with positive *gauge block* accuracy.



***This unit is the Magna-Sine for both single and compound angular set-ups. It can be used for parallel work, single angle or compound angle set-ups. Available in two sizes.**

Send for completely descriptive bulletin showing models and prices. See how YOUR shop can save by using Magna-Sines on all surface grinders as well as angular set-ups for inspection, jig boring and other precision operations.

OMER E. *Robbins* COMPANY

Manufacturers of the MAGNA-SINE and Other Precision Tools

5722 Twelfth Street • Detroit 8, Michigan

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Dependable Available

ABC DRILL JIG BUSHINGS

HEADLESS PRESS FIT • SLIP RENEWABLE
FIXED RENEWABLE • HEAD PRESS FIT
Also HEADLESS LINERS, LOCATING JIGS, LOCKSCREWS, CLAMPS

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Frank A. Hart
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Tool & Die Supply Division
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SOUTH BEND, IND.
Formrite Tool Co.
South Bend 2-3396

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Ellsworth Steel & Supply Co.
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Stock of popular sizes maintained at these locations. Complete factory stock and warehouse at Garwood, N. J.

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ACCURATE BUSHING COMPANY

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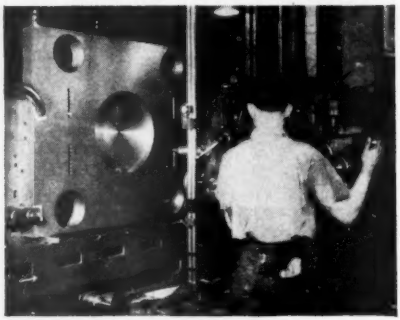
A PRODUCTO DIE SET

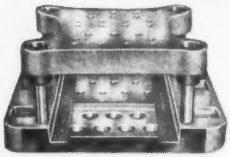
GIVES YOU EXACTLY WHAT WE PUT INTO IT... *Precision!*

The background of a Producto Die Set is composed of "Know How," highly developed machine equipment, and skilled craftsmen.

Every set is precision made throughout... with the extreme accuracy that insures correct alignment of guide pins and parallelism of punch and die holder. Our careful machining, like the horizontal boring operation shown at right, increases die life... minimizes scrap... insures production of quality parts.



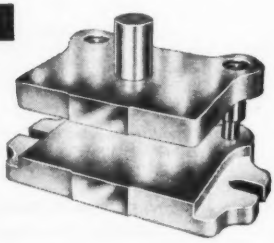
Special DIE SETS



When you give us your specifications for a Producto Special Die Set we consider it an order to be obeyed to the most minute detail. Our special equipment permits production of any type of set from midget size to those weighing several tons... all precisely machined and perfectly finished in every respect. Special folder or catalog on request.

Catalog DIE SETS

Both Master and Standard Sets are immediately available from assembly plants in seven major stamping centers and also from strategically located stocks throughout the country. Hundreds of sizes in many styles cover your requirements for use with all standard punch presses. Call our nearest representative for complete details ... or write for Catalog.



THE PRODUCTO MACHINE COMPANY

970 Housatonic Avenue
Bridgeport 1, Connecticut • Tel. 4-9481

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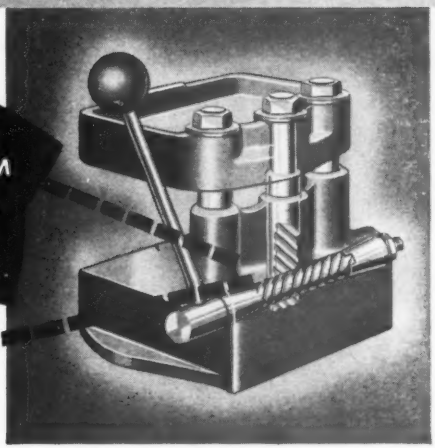
LOCKING MECHANISM WEARS IN —NOT OUT

"CONE-LOK"



THE JIG WITH A LIFETIME* Guarantee ON THE LOCKING MECHANISM

● Just think of this. It's no longer necessary to carry an inventory of spare parts. And when you eliminate costly inventory you *save again* in storage space and taxes! Add to this the saving on maintenance costs and down time on production. Don't overlook these values when planning your 1950 program. Write for literature, complete details.

* *We absolutely guarantee forever the locking mechanism on the* Cone-Lok.

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N. A. WOODWORTH CO. • 1300 EAST NINE MILE ROAD • DETROIT 20, MICHIGAN

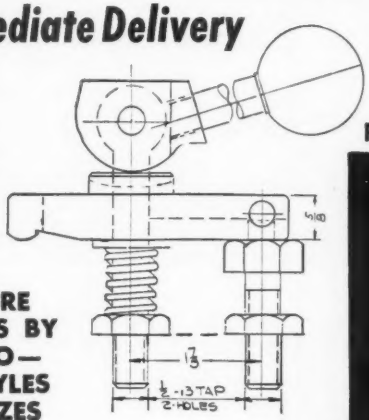
PRECISION GAGES • DIAPHRAGM CHUCKS • CONE-LOK JIGS • PRECISION PARTS

SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

WESPO SAVES YOU up to 70% ON FIXTURE PARTS COST

Order Complete Clamp Assemblies or any of their Component Parts for Immediate Delivery

TEMPLATE DWGS OF ALL CLAMPS & PARTS SENT ON REQUEST



WESPO TYPE NO. 2, CLAMP ASSEMBLY

Below shows Parts of Type No. 2

FIXTURE CLAMPS BY WESPO— 12 STYLES 94 SIZES

Wespo Clamps and parts can be included in your fixture layouts. They are precision made of heat treated alloy steel, cadmium plated. Clamp Assemblies are made in 12 types—94 sizes.

Write for exact scale template sheets and latest bulletin.

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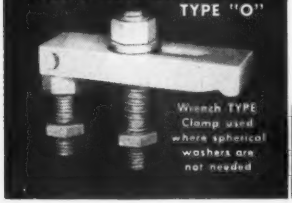

WEST POINT MFG. CO.

19625 MERRIMAN COURT
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350 FIXTURE PARTS WRITE FOR CATALOG

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SOLID CARBIDE

HOKE PRECISION GAGE BLOCKS

a solid foundation of PRECISION on which to build your reputation for Accuracy and Interchangeability

- Attachments in same box
- Choice of Six Standard Sets
- Individual Carbide Blocks to replace worn steel blocks
- Available through all P&W Branches

HERE are the Gage Blocks that will give you trustworthy *Basic Accuracy* many times longer than steel blocks of equal precision. They are made at Accuracy Headquarters by the nation's finest craftsmen to guaranteed tolerances of +4, −2 millionths of an inch per inch of length. All P&W Carbide Hoke Blocks — from .050" to 4.000" long — are *Solid Carbide*, made from a grade which we believe offers the best possible combination of these qualities: wear resistance, surface finish, wringing ease and permanent stability. The results are extremely long service life and continuing Accuracy — *plus substantial savings!* Write for circular.

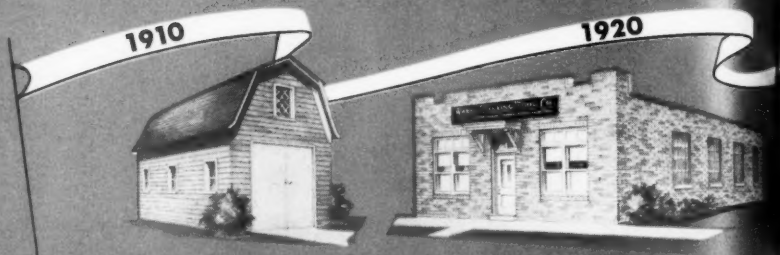
PRATT & WHITNEY

Division Niles-Bement-Pond Company
WEST HARTFORD 1, CONNECTICUT

MACHINE TOOLS • CUTTING TOOLS • GAGES

90th P&W Year

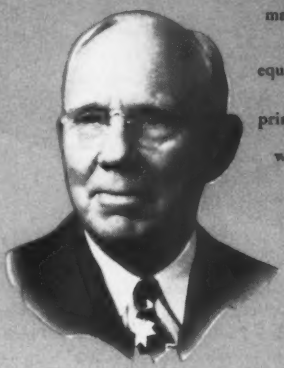
SYMBOL OF ACCURACY SINCE 1860



Our First Forty Years . . .

We are celebrating our Fortieth Anniversary this year with some pride of accomplishment and with a good deal of gratitude to the people who have made this possible.

These include our thousands of friends throughout North America and beyond who have bought our diamonds and diamond products; our many suppliers whose cooperation is so essential, and our company "family" of workers in our several plants and field offices who make, distribute, and service our products.



We have seen this family grow from our original group of three beginners to an organization of nearly two hundred including many outstanding specialists. And, with them, we have graduated through the years from an unheated garage (with practically no equipment) to the most modern of plants and the finest of equipment, much of it exclusive.

Together, we have seen the diamond tool changed from a primitive, handy-man product to a thoroughly scientific tool "engineered to the job" in accordance with the principle which we pioneered forty years ago and developed into recognition throughout industry.

To all of these friends—customers, suppliers, co-workers—our sincere thanks.

WHEEL TRUEING TOOL COMPANY

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WHEEL TRUEING TOOL COMPANY

Established 1910

3200 West Davison Avenue • Detroit 6, Michigan

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WHEEL TRUEING TOOL CO. OF NEW JERSEY
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LARRY CARTER
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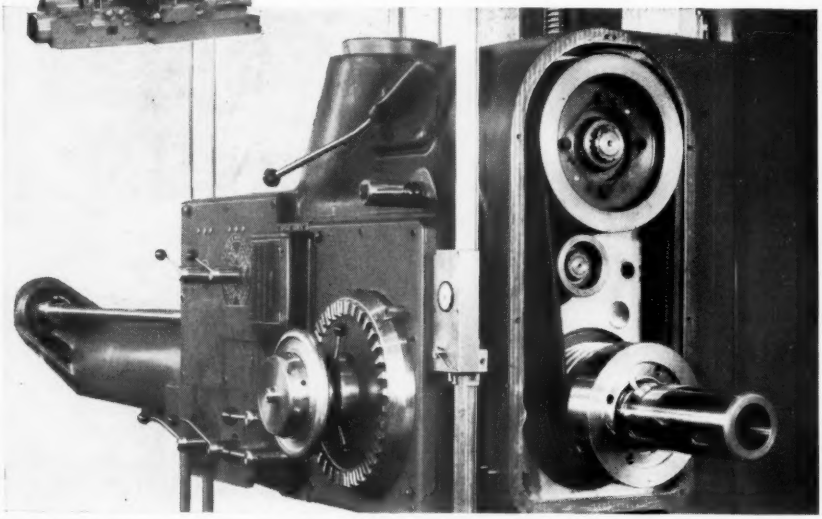
Diamond Sorting

Time-saving single spindle

Vibration-free drive at high speeds

. . ONLY LUCAS HAS IT



SINGLE SPINDLE — Lucas Precision horizontal boring, drilling and milling machines incorporate three speed ranges to a single spindle. The low range is through a gear of larger diameter than the largest milling cutter normally used on this machine. The intermediate range is also gear driven, while the high speed range drives through multiple V-belts directly to the spindle sleeve.

VIBRATION-FREE DRIVE — In the high speed drive through the multiple V-belts, the integral low and intermediate heavy rim gears mounted on the spindle sleeve are out of mesh and act as a flywheel to produce a vibration-free drive for carbide tools.

The operator can change from one speed to another by a convenient lever mounted on the spindle head. With the full speed range available on the single spindle, the operator can perform operations of drilling and boring at proper speed with one setting of the spindle head.

Wherever they are in service, Lucas Precision horizontal boring, drilling and milling machines accomplish basic savings in tools and time. Their versatility is so great that they are kept in practically constant use

FIFTY YEARS LUCAS ONE PRODUCT

Built in 3", 4", 5" and 6" spindle models, all available with Automatic Power Positioning which eliminates jigs and fixtures and makes the horizontal boring machine a highly accurate production machine. Work ranges from 36"x 36" to 96" x 120". All sizes furnished with either two-way or four-way beds. Write for descriptive literature.

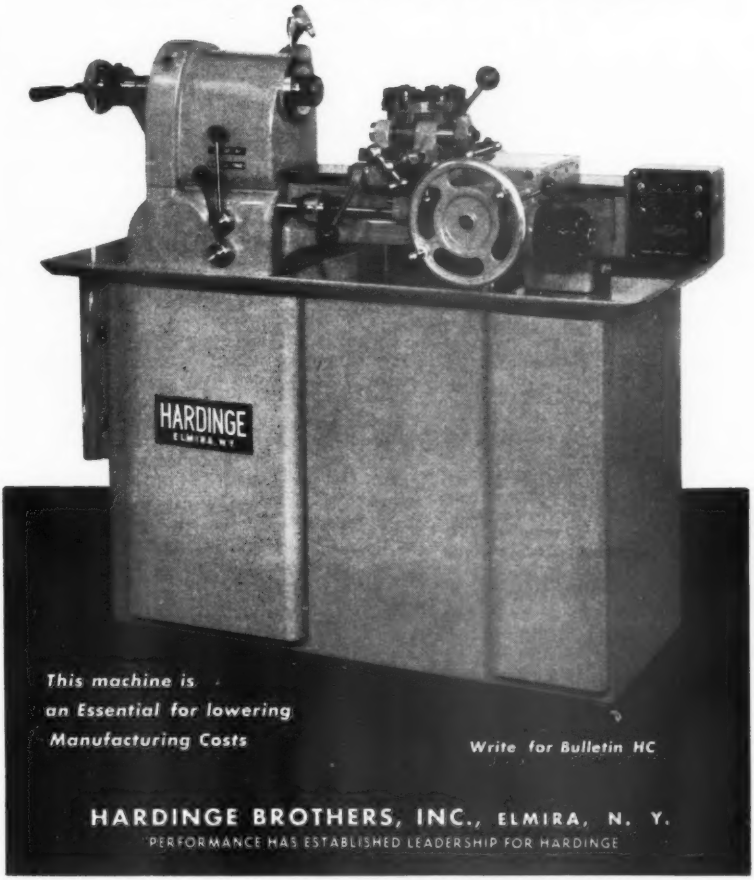
LUCAS

Precision

HORIZONTAL BORING, DRILLING AND MILLING MACHINES
LUCAS MACHINE DIVISION, THE NEW BRITAIN MACHINE CO.
CLEVELAND 8, OHIO

HARDINGE
ELMIRA, N.Y.

HIGH SPEED CHUCKING MACHINE



This machine is an Essential for lowering Manufacturing Costs

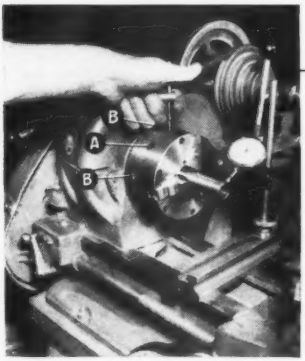
Write for Bulletin HC

HARDINGE BROTHERS, INC., ELMIRA, N. Y.
PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE

Offices in principal cities. Export office 269 Lafayette St., New York 12, N. Y.

SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

First Chuck Advance In *50 YEARS* !!!



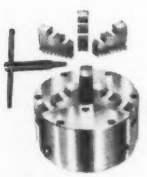
Buck AJUST-TRU CHUCKS

1. **.0005 Precision with scroll chuck speed!**
2. **Collet and Step-Collet functions at scroll chuck cost!**
3. **New 6 Jaw chucks end most needs for Stub Arbors and Mandrels!**
4. **Compensate for spindle run-out to lengthen useful life of old machines!**

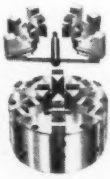
HOW THEY WORK

Pinion "A" moves jaws in or out to grip work like any scroll chuck. 4 opposed screws "B" bring the work to dead center. It's as easy as it sounds. (Men who have never used chucks before have centered work within .0005 in 3 minutes.) Once set dead true the same machining on duplicate parts (from two to hundreds) can be done without changing adjustment!

Right at a time when the big push for production is on comes this revolutionary new idea in chucks to help win the battle. Here — at ordinary scroll chuck prices — are chucks that give you the precision of 4 Jaw chucks, *plus* spindle collet capacity of ⅛" to 1½" by .001, *plus* step collet capacity of ⅛" to 5" (on 6" chucks) by .001. Think of the hundreds of dollars to be saved on machinists' time, on collets, on stub arbors, mandrels, and special fixtures. But that is only part of the great news. Write today for illustrated literature with complete details.



3 STEP-JAW CHUCK



6 STEP-JAW COLLET CHUCK

6 JAW PRODUCTION COLLET CHUCK

BUCK TOOL CO., 1018 Schippers Lane, Kalamazoo, Mich.

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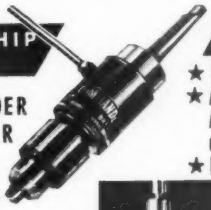
CUT LABOR COSTS with Commander PRODUCTION TOOLS

Adjustable MULTI-DRILL

★ DRILLS UP TO 8 HOLES AT 1 STROKE
★ ADJUSTABLE TO *ANY* HOLE PATTERN
★ FITS *ANY* DRILL PRESS

You can drill 2 to 8 holes at one stroke of a MULTI-DRILL equipped drill press. Instantly and easily adjusted to any hole pattern . . . compact in design and ruggedly built for years of service, thousands of MULTI-DRILLS are cutting costs and increasing output up to 800% wherever metal, wood or plastics are drilled.

New DRILL CHIP BREAKER



Get these COMMANDER DRILL CHIP BREAKER benefits now:

- **Faster Drilling**
- **Deeper Holes**
- **Better Holes**
- **Longer Drill Life**
- **Safer, Cleaner Work**
- **REDUCED DRILLING COSTS**

ORDINARY CHIPS

CHIP BREAKER CHIPS

Write for illustrated Circulars and name of your nearby Commander Distributor.

See us at Booth No. 402 National Metal Exposition, Chicago, Oct. 23-27.

COMMANDER TAPPER

★ 1 Tapper Handles Taps #0 to ¾"
★ Automatically Sensitive... Any Operator Can Do Precision Tapping
★ Fits ANY Drill Press

Commander Tappers "think for the operator"—automatically stop when taps are dull, overloaded, or when they strike bottom in blind hole tapping—permit faster tapping, better work, even with inexperienced operators. Torque control provides positive tap protection from #0 to ¾"...spring clutch eliminates slippage, assures smooth, quiet, easy operation.

Commander MANUFACTURING CO.
4228 W. KINZIE ST. • CHICAGO 24 ILL.

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RECIPE FOR A Better DRILL BUSHING!

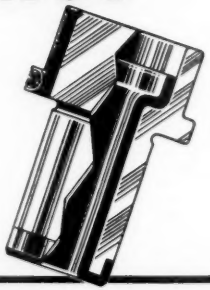
Take a hole and wrap high quality bushing material around it for longer life ★ lower cost

Revere REVOLUTIONARY DRILL BUSHINGS

Yes . . . . that's what we actually do . . . . wrap high quality bushing material around a hole and presto . . . . Revere Revolutionary Drill Bushings are born.

Revere bushings have all the accuracy of solid type bushings with a wearing surface of high grade material. Assembled in a die cast body.

Revere bushings last longer . . . lower cost . . . A new service . . . . and are assembled from complete stocks near you.



Revere Fisher ENGINEERING COMPANY
LEXINGTON, MICHIGAN

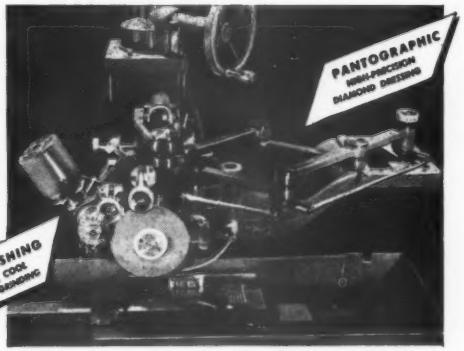
PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

Now you can combine roll-crushing and diamond dressing in a single wheel dresser to speed form grinding

Before the development of the Moore Panto-Crush Wheel Dresser, diamond dressing and crush-forming of surface grinder wheels called for the use of separate devices. These required considerable set-up and operating skill, particularly where odd contours other than true radii and straight surfaces are involved.

Now with the Moore, permanently mounted on the wheel spindle of a surface grinder, both crush-forming and diamond-dressing are accomplished in a single mechanism.

Here's how this 2-in-1 machine does it:



1. Combines Pantograph, working directly from template, and *Roll-Crushing* in one device, accurately related to spindle.

2. Switches from one method to the other without disturbing workpiece setting or location of either trueing device.

3. No setting up of complex attachments each time wheel is dressed . . . no raising of wheel spindle from work to dress, yet wheel spindle may be raised or lowered without losing relation of wheel form to dressing device . . . crusher method saves diamond costs.

4. Assures highest roll-crushing accuracy and economy. Crusher roll is *ground* and used on same spindle, without disturbing position . . . no expensive machine required to grind crusher roll . . . no worry about hardening distortion, because roll is ground *in place* from the solid directly from template.

5. Takes Skill out of job, yet adds advantage of crush dressing for heavy cuts without heating work, and ultra-precision diamond dressing.

6. Device need not be removed to use machine as conventional surface grinder.

Both MACHINE DESIGN and MACHINERY magazines devoted considerable editorial space to technical discussions of the value of this ingenious new mechanism. We'll be glad to send you reprints and a descriptive catalogue on Panto-Crush.

MOORE SPECIAL TOOL CO., Inc.
726 UNION AVENUE, BRIDGEPORT 7, CONN.

HAVE YOU BOUGHT YOUR COPY OF "PRECISION HOLE LOCATION"?

Over 5,000 copies of this valuable book on toolmaking practices have been sold to date. Available at special price of $3 in U. S. A.; $3.50 outside U. S. A. 448 pages, over 400 illustrations. 184 pages of Woodworth Coordinate Location Tables from 1 to 100 inches. Send check or money order to Moore Special Tool Co., Inc., Bridgeport 7, Conn.

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTO-CRUSH WHEEL DRESSERS • DIE FLIPPERS • MOTORIZED CENTERS • HOLE LOCATION ACCESSORIES

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SUPERIOR ALL-STEEL DIE SETS

and always SUPERIOR IN PERFORMANCE

Superior All Steel Die Sets have Exclusive Design Features that make them the No. 1 Set in the field today. Superior's Lock-Jaw Lifting Device and E-Z Lift Sling Chain makes it possible to move Superior Die Sets of any size or weight . . . for any distance, in any direction (illustration above). Superior's Safety Flange safeguards against crushed fingers . . . acts as a connecting link between die set proper and lifting device (illustration left). Superior All Steel Die Sets are carefully processed to meet individual job specifications . . . your guarantee of the finest in performance. Yes, with Superior you get a **Superior Die Set,** in Less Time, at No Greater Cost. Investigate Superior All Steel Die Sets, Today.

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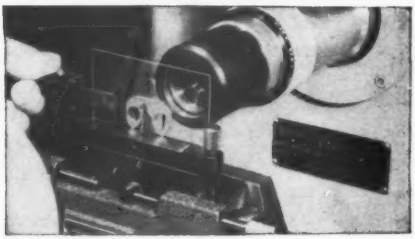
Free CATALOG

with complete information on Superior All Steel Die Sets and Equipment will be sent to you upon request. Write for your copy of Bulletin No. 850 today.

SUPERIOR STEEL PRODUCTS CORP.
2754 SOUTH 19th STREET. MILWAUKEE 7, WIS.

INSPECTION COSTS *TUMBLE*



with AO **CONTOUR PROJECTION**

Unparalleled speed and economy in checking critical components right at the production line is possible with an AO Optical Projection Comparator. ***More light on screen . . . superior optical performance . . . uniform magnification . . . freedom from distortion . . .*** all help observers to inspect quickly and accurately. ***Factory alignment—practically no adjustments for the user to make . . . fingertip controls . . . simple, sturdy, troublefree optics and mechanics . . .*** mean you can depend on the equipment to perform long and faithfully under constant factory usage.

The illustration above shows an application at Whitney Chain & Mfg. Co. In ***one quick operation,*** silent chain links are checked for pitch (distance between holes), diameter of holes, and position of angular edges. Pitch is held to .0005" and diameter is held to ±.0005".

Adaptations of the AO Optical Projection Comparator can be made to meet a wide range of special requirements. For complete information write Dept. K179

American Optical
COMPANY

INSTRUMENT DIVISION • BUFFALO 15, NEW YORK

Makers of Precision Optical Instruments for over 100 Years

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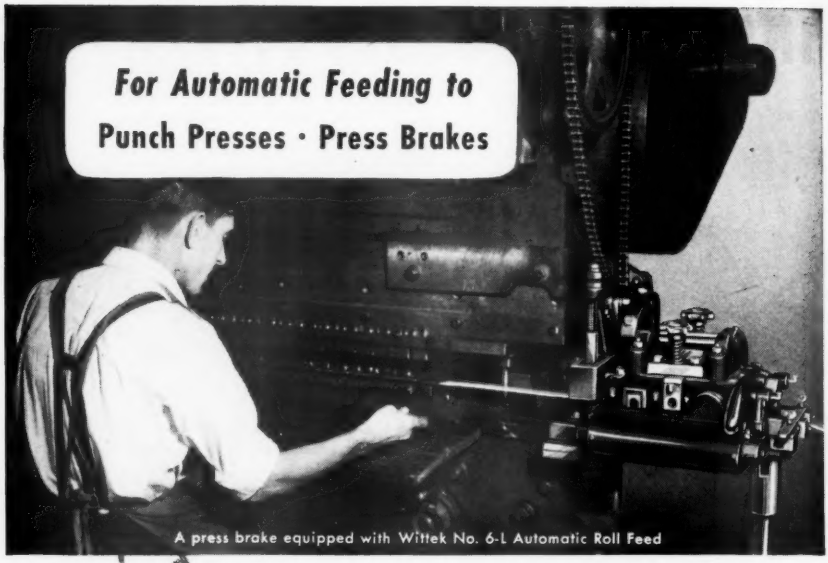
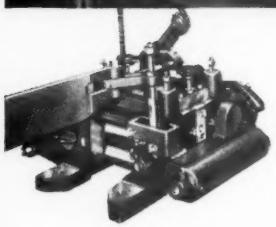
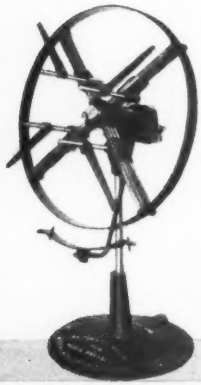


A press brake equipped with Wittek No. 6-L Automatic Roll Feed





You Can't Beat WITTEK

Wittek Roll Feeds are made in standard models to meet every requirement in the automatic feeding of strip stock to punch presses or press brakes. The distinguishing feature is their simple and economical method of operation which does away with complicated parts thereby assuring *speed* and *accuracy* in the feeding of various kinds and thicknesses of material.

Wittek Adjustable Reel Stands are designed as companion units to Wittek Automatic Roll Feeds and are available in seven different models to handle *ALL* types of coiled strip stock and wire being fed to punch presses or similar production machinery.

Special units of Wittek Automatic Roll Feeds and Adjustable Reel Stands are engineered to meet unusual requirements.

Write for complete descriptive literature

WITTEK Manufacturing Co.
4323 W. 24th Place
Chicago 23, Ill.

Automatic ROLL FEEDS AND REEL STANDS

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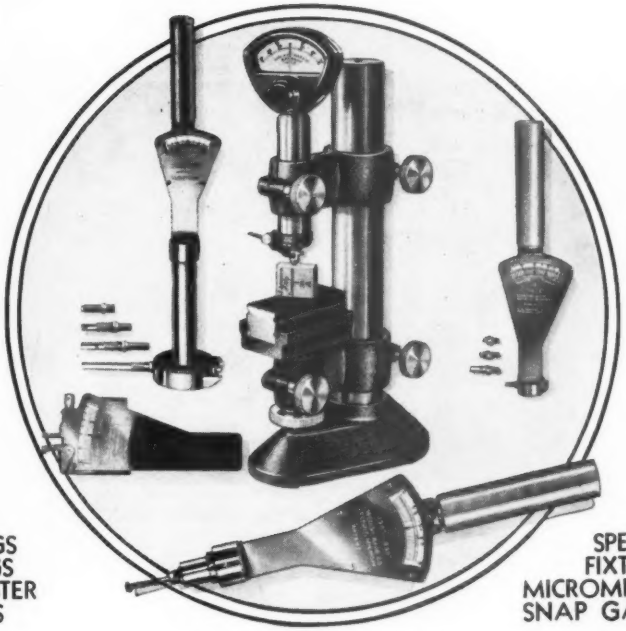

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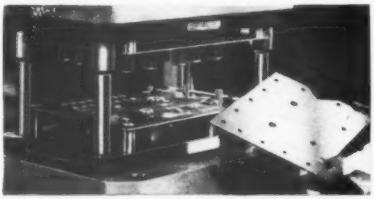

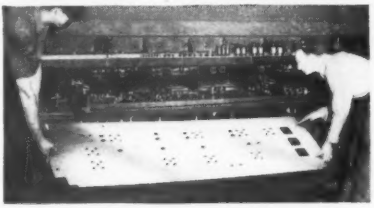

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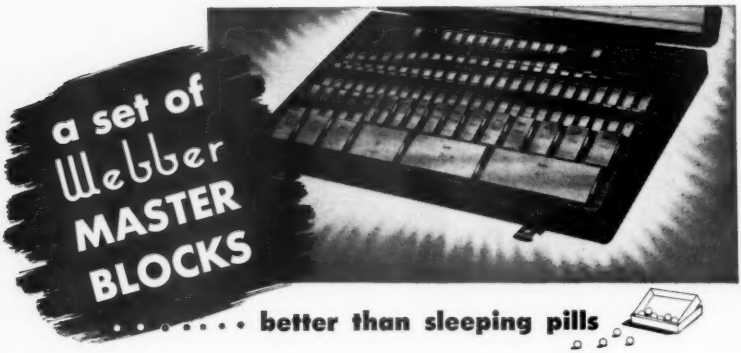

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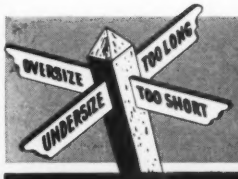

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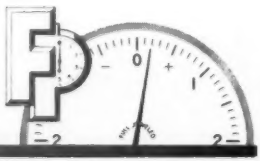

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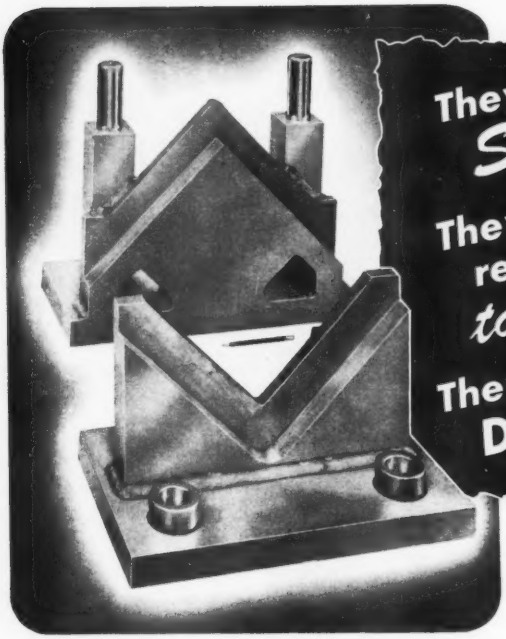

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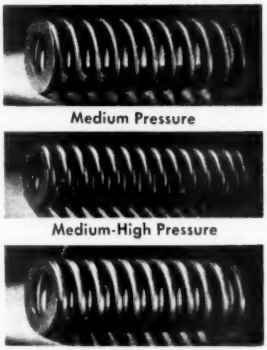

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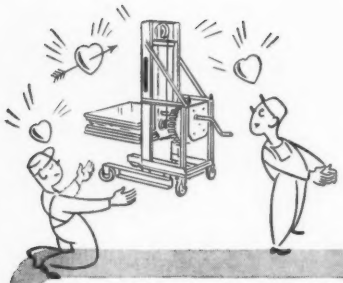

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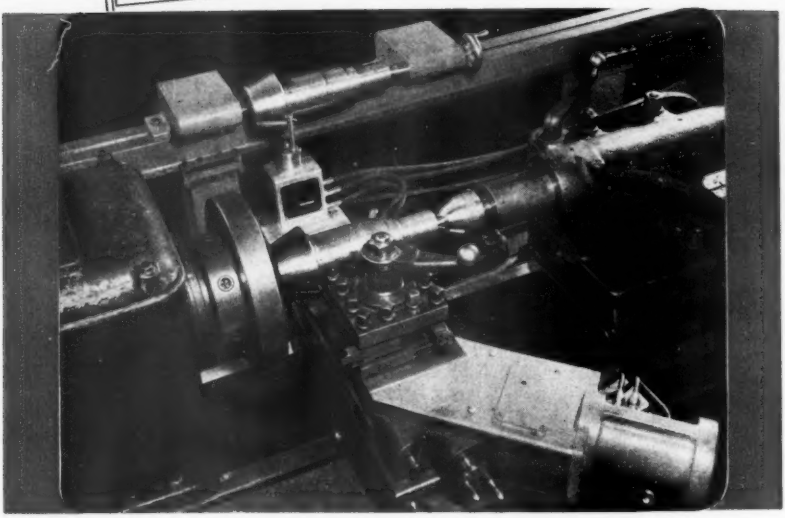

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TOOL & DIE JOURNAL

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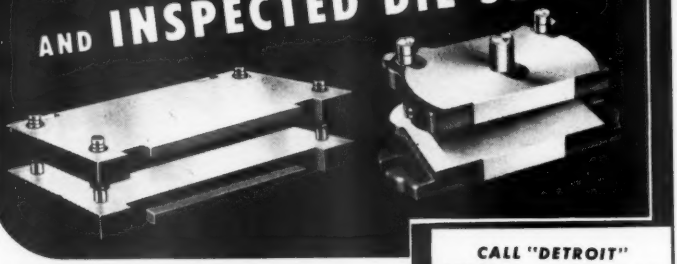

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proof of the pudding

"The whole secret in the case of a manufactured article, for example, lies in controlling the quality during production rather than trying to sort out unacceptable quality after the part or assembly has been completed." **W. R. Weaver, Director of Steel Conservation and Quality Control, Republic Steel Corporation, and President, American Society for Quality Control.**

"This method of proving tools and dies has resulted in a substantial reduction in manufacturing costs. It has meant more realistic production schedules, and inspection has been reduced considerably, since the need of detail inspection has been completely eliminated." **J. Manuele, Director of Quality Control, Westinghouse Electric Corporation.**

"The first thing that will be gained from the quality control program is a revamping of inspection procedures, practices, and methods. Any inspection department not using quality control and which does not 100% inspect the products, is using guess work and old, time-worn, rule-of-thumb practices, some of which are satisfactory but many are very poor indeed. In no case do they have methods by which quality can be unconditionally guaranteed." **Donald J. Greb, Assistant Chief Inspector, Minneapolis-Honeywell Regulator Company.**

"In our overall quality program, the science of Statistical Quality Control has been an increasingly important factor. Through the effective use of control charts at every step of the manufacturing and assembly processes, we are able to maintain and improve our quality level. . . . Sampling inspection—a random selection of a predetermined number of pieces, sampled according to the lot size, followed by giving them a minute inspection, and accepting or rejecting the entire lot based on statistically calculated sample limits—has been adopted in an increasing number of instances, and has proved a more accurate quality barometer than '100% inspection'." **Roscoe Smith, Director, Quality Control, Ford Motor Company.**

"One of the most valuable sets of tools that Statistical Quality Control has provided for industry is the variety of statistical sampling acceptance tables for inspection. Thus far, numerous tables have been developed, each set introducing new symbols and new quality definitions. Basically, they all have the same purpose which is to guarantee protection against passing defective products through inspection." **W. H. Coughlin, Tapco Quality Control Engineer, Thompson Products, Inc.**

The above quotations are from the respective authors in this, TOOL & DIE JOURNAL's 3rd Annual QUALITY CONTROL Feature Issue. We feel that it undoubtedly represents the finest, most authoritative and most comprehensive presentation of QUALITY CONTROL know-how and show-how ever offered by one issue of a technical publication.

Planned, as it was, in more peaceful times, the advent of Korea makes these eminent authorities' words of even more critical importance to manufacturing management. A fuller understanding of the workings of QUALITY CONTROL will go far to ease many of the problems now arising as industry is charged with superimposing a military production program upon an all-time high in civilian goods output.

These problems involve: greater productivity of the highest quality acceptance from machines, tools and men; the accelerating demand for precision production of the instruments of defense and war; a labor force that can be expanded only by drawing on unskilled and elderly workers; the higher production at lower cost that is essential both to our military budget and to act as a brake on inflation.

Again, as in World War II, you TOOL & DIE JOURNAL readers who constitute manufacturing management are looked to for the solutions to these critical problems. It is our hope that our authors' comprehensive coverage of today's workings of QUALITY CONTROL may contribute measureable assistance in meeting your multiplying responsibilities.

E. Willard Pennington

editor

QUALITY
Measuring - Testing - Inspection
CONTROL

Quality Control's March of Progress

by **W. R. Weaver**

Director of Steel Conservation and Quality Control
Republic Steel Corporation
and
President
American Society for Quality Control

The official origin of modern Quality Control has been recognized as a memorandum prepared by Dr. Walter A. Shewhart, then an engineer with Western Electric, for Mr. R. L. Jones, an executive of that manufacturing supplier to the Bell System, dated May 16, 1924. The principles underlying this memorandum were expanded and developed into a system for use in controlling the quality of a manufactured article during production, and for many years progress was slow due to lack of widespread acceptance of the underlying ideas. Hence, the field of application and use was resultantly somewhat narrow.

The next milestones appear to be in 1940 and 1941 with the publishing by the A. S. T. M. of a Manual on Presentation of Data (Committee E-1, Harold F. Dodge of Bell Laboratories, Chairman) and the American Standards Association "War Standards" manuals under Committee Z-1. Mr. Dodge was likewise Chairman of this Committee. These important documents have served as textbooks for countless numbers of training courses and are in current use as "bibles" throughout the country today. Associated with their development are such prominent names as J. T. MacKenzie, R. T. Webster, A. E. R. Westman, H. G. Romig, R. F. Passano, A. G. Ashcroft, W. Edwards Deming, Leslie E. Simon and R. E. Wareham.

Meanwhile, the first organizational effort directed at the still relatively unknown field occurred in Pittsburgh on April 19, 1941, when a group of twenty-four individuals representing fourteen different organizations formed the "Society of Industrial Statisticians". Many of these are leaders today in the field of modern Quality Control.

A specially selected staff under the auspices of the OPRD-WPB started in 1943 to present a series of courses on training within industry titled "Quality Control by Statistical Methods" and as an outgrowth of these courses numerous follow-up groups throughout the country formed local organizations. These various groups collaborated among themselves in numerous ways and a noteworthy product of one such collaboration was the bringing forth of a periodical, "Industrial Quality Control", under the leadership of Dr. Martin A. Brumbaugh of the University of Buffalo, in July of 1944.

Recognizing the need for National consolidation of ideas and efforts to guide an already vigorously growing field, the leaders of the various local organizations in the country, 17 in number and comprising 1,250 individuals, began to lay plans for a National technical society. Their efforts finally culminated in the formation of the American Society for Quality Control in New York on February 16, 1946. There was doubt in the minds of many about there being a place for such a Society, but its membership, both professional and non-professional in character, was determined. Here was a focal point for all ideas, a clearing house for the problems and answers and an ideal means for dissemina-

(Continued on page 96)

Tools and Dies Determine Quality

The use of tools and dies is a method of transferring skill from the worker to the machine. Resort is had to the use of tools where it is desirable to produce products of the same high quality as might be expected from a skilled craftsman, but where production must be in quantities and at a cost which cannot be achieved by handicraft methods. Therefore, great reliance is placed on the ability of tools to make parts of the highest uniform quality. Tools which have been built and adjusted correctly will produce parts of the desired quality. Products produced with such tools generally will require no further inspection, and can be depended upon to give the ultimate consumer entire satisfaction.

However, it is necessary to prove that a tool can perform as intended. This proof may be obtained by running an $\bar{X}$ and R chart on the initial production, when the tool is first put in service, to determine the average quality and range of variability of quality of the product being produced. If the tool is not producing as required, it is necessary that it be taken out of production and returned to the tool room for correction. This correction must be in line with the findings reflected in the $\bar{X}$ and R chart.

If the average, $\bar{X}$, of the quality characteristic being controlled is too high, or too low, the tool must be adjusted to correct this condition. Perhaps the method of locating the part in the tool must be changed; or, perhaps the mold closes too tightly or not tight enough. The principle to bear in mind is that the average, $\bar{X}$, can be changed as desired simply by making some adjustment on the tool, mold, or fixture.

However, if the range, R, is too great, it is an indication that the tool is too erratic in its operation. This may mean that the material is not of uniform quality; the tool or mold is not operating the same on every cycle; the parts are not always located in the tool the same way; or the operator may not be properly cleaning chips and residue from the tool or mold before each loading. Sometimes the specification tolerances may be too narrow for economical manufacturing.

by **J. Manuele**
Director of Quality Control
Westinghouse Electric Corporation,
East Pittsburgh, Pennsylvania

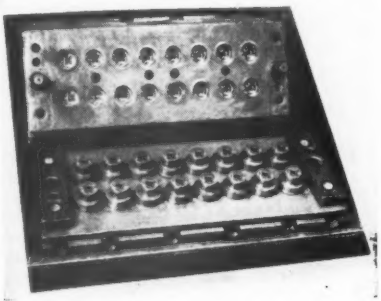


Fig. 1. This 16-cavity mold, producing the part shown in Figure 2, gave the quality control data tabulated in Figures 3 and 4.

Whatever the assignable cause may be which is causing the production of defectives, it must be found and corrected. This may mean a trip back to the tool room so that the tool can be reworked.

It is these trips back to the tool room which interfere with production and increase manufacturing costs. Therefore, it is necessary that a new tool be proved BEFORE it is put into production and then the $\bar{X}$ and R chart can be used merely as a check to see that the tool CONTINUES to produce as intended.

The proper, and most economical, procedure is to take care of this TOOL PROVING in the original tool estimate. Generally, information is available on what the probable cost of the tool will be. To this probable cost should be added the cost of making a pilot run of the product to be made by the tool, plus the cost of inspecting the production of this pilot run, and the cost of reoperating the tool in line with the information obtained from the inspection of this pilot run production. For example: It may be estimated that a tool may cost $20,000. From consulting with the shop person-

nel who are to use this tool it is determined that a pilot run to make a proper statistical analysis of the quality of the product may require another $1,200 for labor, material, and indirect factory expense. This will cover the cost of placing the tool in production, making the parts, and taking the tool back out of production. The cost of inspecting the parts and making a proper quality analysis may be as high as $200 depending on the complexity of design of the parts. Previous experience might indicate that it will cost $3,000 to reoperate the tool to correct errors disclosed by the pilot run. Therefore, the final estimate for the tool should be $20,000 + $1,200 + $200 +$3,000 or $24,400.

In this manner the total cost of the tool is determined at the beginning and no difficulties will be encountered later in trying to obtain funds for correcting minor defects, or determining "who is to pay for it."

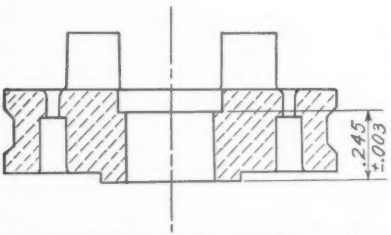


Fig. 2. The pilot run determined the tool rework necessary for this part to be produced within the specification shown.

In a similar manner the time required for fabricating the tool should be estimated by taking into consideration the time required for making the pilot run; plus the time required for making a quality analysis of the pilot run production; plus the probable time required for reworking the tool. For example: It may be estimated that it will require seven weeks to fabricate a particular tool It will require one week to make a pilot run, inspect the parts, and make a quality analysis of them, including the construction and interpretation of $\bar{X}$ and R charts for the various quality characteristics to be controlled. It will require another three weeks to make whatever corrections are required on the tool. Therefore, the total time required for producing the tool so that it might be placed in permanent production is not seven week , but 7 + 1 + 3 or 11 weeks. Hence, if production is to start on a particular date, it is necessary to bear in mind this eleven weeks required for fabricating the tool. Therefore, the tool must be ordered eleven weeks in advance and not seven.

An example will serve to illustrate this point. The tool shown in Figure 1 is a 16 cavity mold used for producing the thermosetting plastic material part shown in Figure 2. An initial run, or pilot run, of the tool was made at which time 33 moldfuls, or cycles, were molded. That is, 33 parts were made in each of the 16 cavities; the mold was filled and put through a complete cycle 33 times.

Each of the 33 parts produced by each cavity was measured and both the average and standard deviation (σ) were determined for each cavity. For this purpose each cavity was numbered, and the parts were segregated to the cavity which produced them. These data are shown in Figure 3.

It can readily be seen from this information that the process is able to

(Concluded on page 132)

Average and Standard Deviation of Each Cavity During Pilot Run

Cavity No.	$\bar{X}$	σ	3σ
1	.2471	.000918	.002754
2	.2535	.000918	.002943
3	.2578	.001025	.003075
4	.2573	.000589	.001767
5	.2559	.000840	.002520
6	.2599	.000701	.002100
7	.2576	.000507	.001521
8	.2542	.000604	.001813
9	PIN	BROKEN	
10	.2513	.000493	.001389
11	.2589	.000961	.002883
12	.2510	.000522	.001566
13	.2572	.000708	.002124
14	.2532	.000660	.001980
15	.2558	.000750	.002250
16	.2571	.000660	.001980

Fig. 3. Data compiled during tryout.

Organizing the Quality Control Program

During the last few years a very large number of excellent articles on quality control have appeared in nearly all the technical journals and publications. Practically all of these have been devoted to descriptions of how quality control techniques have been applied in specific plants or to specific problems and to the general fundamentals of quality control.

Conspicuous by their absence are some pointers on how to start a quality control program, how to organize it, how to staff it, and what to expect from it. After all, every organization using quality control techniques must have some organization, definite or otherwise, and has to be staffed. It is hoped that this article will provide some help to the multitudes who are on the verge of getting into quality control but who do not quite know how to go about it.

Organization

There are two major problems in getting a quality control program under way. First, the quality control group must be organized and fitted into the present company organization with a minimum of disruption of lines of authority. Secondly, the quality control group must be properly staffed.

The status quo of the inspection department of the company determines in a large measure how the new quality control program should be fitted into the company organization. This is true because no matter what type of activities quality control eventually gets into, most of those activities have a direct bearing on the operations of inspection. All quality control programs will end up about the same, i. e., inspection and quality control will be submerged in each other and be practically synonymous. There are two fairly clear cut choices for organization and one not so clear.

First, if the inspection department is independent of all other departments and reports directly to management, and if it is progressive, well-managed, and receptive to new ideas, and looked upon by management as something more than a necessary evil, then the quality control program can be easily fitted into the inspection department with the Chief Quality Control Engineer reporting to the Chief Inspector.

This is a good situation because it takes advantage of an existing well-defined organization, lines of authority will be quite undisturbed, and the introduction of quality control will be quite smooth. This organization is subject to one disadvantage which in certain places could be very severe. Operating as part of the inspection department, quality control is carried as a staff or advisory group and as such has no actual authority. Its recommendations must be executed by the line supervision of the inspection department and if there are any spots where quality control techniques and ideas are not well received and firmly believed by the line supervision, progress in these places will be negligible.

In spite of all the salesmanship and diplomacy that can be employed, there will almost invariably be some old line inspectors and supervisors who are convinced that quality control is a fine thing as long as it is kept away from their departments, and who think quality control is here to take away their jobs. To expose the quality control program to effective sabotage from within the inspection department is a defect of this type of organization that cannot be ignored. If this organizational setup is to be employed, it should be done with the firm conviction that situations as above will be adequately dealt with.

Secondly, if the inspection department is weak, unprogressive, or subject to some other department such as engineering or production, the only possible

by Donald J. Greb
Assistant Chief Inspector
Minneapolis-Honeywell Reg. Co.
Minneapolis, Minnesota

USE OF INSPECTOR'S PARTS CLASSIFICATION SHEET

All parts listed on the following sheets are to be inspected strictly according to the sampling plans as specified. The dimensions and visual defects that need to be watched as noted are those which have caused or are likely to cause trouble in assembly.

All three-place decimal dimensions under 1.000" are written without the decimal points such as 891, 042, 125. Those dimensions which have equal + and − tolerances have the tolerance listed such as 262± 005, 425± 002. Those dimensions which have unequal tolerances do not have the tolerances listed at all. For example $.218^{+.000}_{-.002}$ is listed as only 218. This has been done to save space and typing and the one number should identify the dimension without trouble.

All four-place decimal dimensions and dimensions over 1.000 are written with the decimal point such as 1.697, .4195, etc.

Some standard abbreviations have been used:

D—diameter
R—radius
N—lot size
n—sample size
c—allowable number of defects

Combining Lots:

Occasionally it may be advantageous to combine several crates, pans, trays, etc. of the same part rather than inspect pan by pan. It is only desirable to do this when the parts are known to have a good history and are not likely to be rejected. The procedure in such cases is to find the total number of parts to be sampled at once and draw a sample corresponding to the total lot size, being careful to draw some parts from each pan, crate, etc. For instance if you have six pans of parts with 3200, 8000, 6450, 3100, 5275, and 6425 parts the total parts is 32450 and the sample corresponding to 32450 should be drawn with some parts from each pan. If such a sampling rejects the total lot there are two alternatives:

1. Reject the whole lot to be sorted.
2. Resample the individual pans just as if the original sampling had never been done.

Different Classifications for Different Characteristics:

On some parts, one or two dimensions or characteristics may be class 1, for instance, and others class 2 or 3. In those cases inspect for each class separately and reject if any class of defect is too high. For example, it would be possible to pass a class 1 dimension and reject for a class 2. Then the sorting needs to be done only on the class 2 dimensions.

DIMENSIONS not listed:

Dimensions not specifically listed should be checked at the discretion of the inspector. Probably a few parts should be checked to see that the unlisted dimensions conform reasonably to print. These unlisted dimensions will not be specifically mentioned until such time as they cause trouble in assembly.

Fig. 1. The acceptance and rejecting of pieceparts in various sized lots must be based on scientific, economic sampling. Reproduced below are the Minneapolis-Honeywell Regulator Company's instructions covering the use of the charts shown in Figures 2 and 3.

thing to do is set up quality control as an independent department reporting directly to management and to make inspection a part of and subject to quality control. This is perhaps the ideal setup because quality control is then responsible for both the initiation and execution of the techniques and the risk of having the quality control program bog down is minimized. If there are any doubts at all about the strength and progressive nature of the inspection department and its line supervision, this sort of organization is best.

The third situation is not so easy and occurs where inspection is strong and progressive but not independent. In such cases quality control can either be fitted into inspection or inspection pulled out from the other department and made independent. I don't think there is too much question but what the latter is preferable but it may not be too easy to do.

Staffing

Equal in importance to the organization of quality control is the manner in which it is staffed. The quality control supervisor will be primarily an administrator and organizer. He should be an

SAMPLING PLANS FOR CLASSIFIED PARTS

N—lot size | n—sample size | c—allowable number of defectives

CLASS 1 PARTS			CLASS 2 PARTS			CLASS 3 PARTS		
N	n	c	N	n	c	N	n	c
0-475	36	0	0-160	12	0	0-200	10	1
476-1570	84	1	161-520	27	1	201-1000	24	3
1571-3830	135	2	521-1270	45	2	1001-6000	47	6
3831-8200	190	3	1271-2700	64	3	6001-28000	72	9
8201-15300	250	4	2701-5100	84	4	28001-100000	100	12
15301-28500	315	5	5101-9500	105	5			
28501-50000	380	6	9501-16700	125	6			
50001-84000	445	7	16701-28000	145	7			
84001-100000	510	8	28001-46000	170	8			
			46001-75000	190	9			
			75001-	215	10			

CLASS 4 is our special method of checking springs and bellows unless otherwise noted.

engineer and familiarity with company products is desirable but not necessary. Many companies will not have available in their organization a man qualified to take over the supervision of quality control and will have to employ someone from outside who may be a total stranger to the company's line of work. This is not a serious disadvantage, however.

The personal and educational qualifications necessary for the top notch Quality Control Engineer are rather stringent but the supervisor who selects his men very carefully will reap rich rewards for his quality control program.

In starting a program the natural tendency is for the supervisor to look into the shop for an inspector, an operator, or minor supervisor who is somewhat above the average of his associates. The assumption is that the familiarity with company products and procedures which these men possess will be invaluable in quality control work. It is true that their

(Continued on page 86)

Fig. 2. (above) Chart showing sampling plans for parts classified as to different dimensional specifications. Fig. 3. (below) A chart used to identify defects and dimensions that call for special vigilance. These organized inspection procedures insure quality control.

MANUFACTURING DEPARTMENT

INSPECTOR'S PARTS CLASSIFICATION SHEET

Part Number	CLASS 1	2	3	4	Defects and Dimensions that Need to be Watched
25413B			x		Check hole location with G7169
25413C			x		Check hole location with G7170
26128	x				Poor knurling 458 ± 002, 186 D
26957	x				Poor knurling 458 ± 002, 186 D
30291		2			1-72 screwhole
30296	x				8-32 tap o-s
30298		x			2-56 hole either o-s or u-s
32206			x		6-32 tap
32461			x		
32476		x			All decimal dimensions
32477	x				Cutoff burr 1-32 010-012 R
32479		x			Missing line reaming op. 065 ± 001 218 ± 002 R
32482		x			126
32484		x			215 ± 001 must not be o-s
32745		x			Metal chips in slot 040, 155 ± 001

(Left) On Final Assembly Line an inspector gives final check to 1950 Ford. Note Quality Control chart in background. (Below) Quality Control analyst studying chart at end of Ford Trim Line, Dearborn Assembly Plant. Before these end results are attained, the utilization of Quality Control becomes a part of the relationship between the company and its suppliers. Mr. Smith's article shows how this has been accomplished.

Vendor Quality Certification

The interest of the Ford Motor Company in Quality Control techniques is a logical outgrowth of its never-ending search for better ways to build a quality automobile.

In our over-all quality program, the science of Statistical Quality Control has been an increasingly important factor. Through the effective use of control charts at every step of the manufacturing and assembly processes, we are able to maintain and improve our quality level. It is our hope that our experiences and our efforts in the general field of Statistical Quality Control have added and will continue to add to the general body of knowledge in that field.

Sampling inspection—a random selection of a pre-determined number of pieces, sampled according to the lot size, followed by giving them a minute inspection, and accepting or rejecting the entire lot based on statistically calculated sample limits—has been adopted in an increasing number of instances, and has proved a more accurate quality barometer than "100% inspection."

by Roscoe Smith
Director—Quality Control
Ford Motor Company

These facts are fundamental in the experience of Quality Control workers, and it may be unnecessary to point them out here. To some readers, however, Statistical Quality Control may be a new subject, and since some understanding of the difference between 100% inspection and sampling inspection is desirable in any discussion of Vendor Quality Certification, it seems appropriate to mention it here.

Here at Ford we never forget for a moment that we have a large number of suppliers who play a big part in this business of building automotive products. No company, however big, could manufacture economically each and every part that goes into a finished product as complex as a car, a truck or a tractor. Nor should it expect to.

Over the years, the building of many of the vital parts of the automobile has become the province of specialists. Spark

(Left) Quality is safeguarded at receiving inspection locations by careful analysis of samples of incoming shipments. Illustrated here is a typical one of many well-equipped receiving inspection layout sections. (Below) Ford's 1949 slogan contest stressing quality drew thousands of entries. Posters, contests, exhibits, and displays are a few of the many ways in which Ford workers are kept quality conscious.

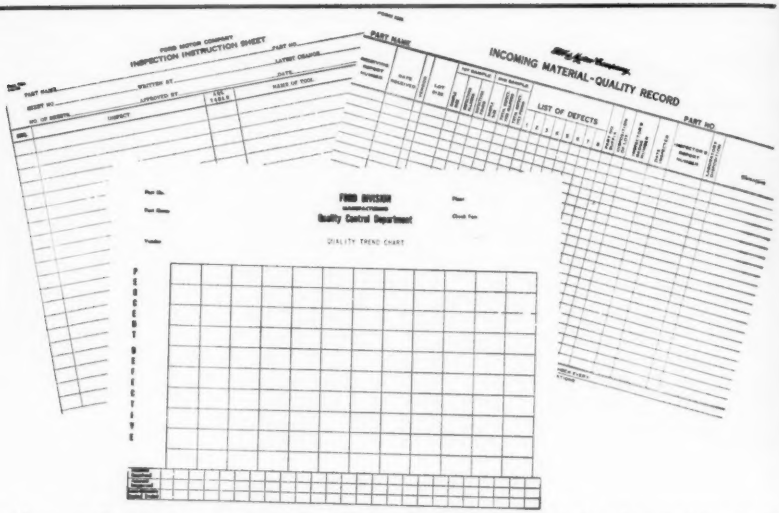
plugs, carburetors, batteries, tires—these are only a few of the hundreds of important items we buy from firms who may devote their entire facilitites to building one specific product.

They know from long experience the problems and obstacles peculiar to their industry. They have met these obstacles and have overcome them. Whenever we issue a purchase order we accept—and respect—this substantial backlog of experience.

Just as our suppliers bring to us the fruits of their experience, so also do we attempt to give them the benefit of our own. Statistical Quality Control, for example, was new to most of our suppliers when we first established it as a basic company policy. As we learned more about it, we passed our knowledge on to them. Long before we embarked upon a program of vendor quality certification, we were helping many of our vendors to establish Chart Control, as we like to call it, in their own plants.

We found a tremendous interest among them in this new science, and a great demand for knowledge and help in obtaining this knowledge. Last spring, for example, the demand for information was so great that we held a special training course in Statistical Quality Control for our vendor representatives. It was attended by 250 persons. The course will be repeated this fall, with registrations for 180 already in.

Without chart control, these suppliers of ours, by and large, have done a highly commendable job for us through the years in supplying us with parts that we—and the customer—could depend on for many thousands of miles of trouble-free motoring. They knew and accepted the quality standards we set up for every purchased part, as well as for every part manufactured by any of our own plants. They knew that shipments of parts below our standards would be quickly rejected, and that rejection was costly.



(Above, Left) On the Inspection Instruction Sheet are recorded the characteristics to be checked, the gages to be employed, and the sampling tables to be used. (Above, right) The Incoming Material Quality Record is a current record of shipments with all pertinent data. (Center) The quality Trend Chart shows the complete receiving inspection quality record and history on any specific part supplied by a vendor. Copies are sent to Management and Purchasing, and Vendors are kept constantly advised of the quality of their shipments.

and that rejection was costly.

Our suppliers, therefore, were obliged to give careful inspection to every shipment made to us; and we in turn carefully inspected each shipment on arrival. Now it is obvious that with a proper agreement on inspection equipment and procedure and on specified quality standards, some of this double inspection must have been unnecessary, but it was the only way we were able to work to safeguard quality.

Sometimes, when a shipment was rejected, the vendor would disagree with us over the basis of our rejection. Since inspection procedure had not been completely standardized and agreed upon, and since the results given by gages and other measuring devices used by the vendor sometimes differed from those used by Ford, it was inevitable that working relationships at times became strained.

That, in brief, was the basis for a new development in our Statistical Quality Control program. We call it Quality Level Certification.

Right here we want to make it clear that our experience with quality level certification is as yet comparatively limited. We still have a great deal to learn about it. Every day we encounter new problems that we did not realize existed the day before. **But if our experience and our approach to the subject thus far can be useful to others who are desirous of entering into a similar program, the telling may be worthwhile.**

Perhaps a practical definition of quality level certification can be achieved by calling it a procedure whereby the vendor assures the buyer that the articles shipped during a stated period are at a certain quality level; that level being at or below a defective level specified in an agreement between buyer and vendor.

As we see it, and as our experience and the experience of others demonstrates, certification has several important advantages. In the first place, a purchase

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Like television, CINCINNATI Projecto-Form Grinding Machines eliminate a lot of intermediate steps and show you exactly what's happening at the point of action. Through an arrangement of lenses and a mirror, an intense light projects a silhouette of the work and wheel to a ground glass screen in front of which the operator is seated. A "drawing" of the desired contour, twenty times size, is cut on a glass plate coated with a tinted translucent emulsion. Mounted on the viewing screen, the drawing furnishes a guide to which the operator works. With two micrometer adjusting handwheels, he adjusts the wheel vertically and transversely while it reciprocates over the work. Grinding continues until the image of the work matches the drawing. You may obtain complete specifications by writing for catalog M-1612.

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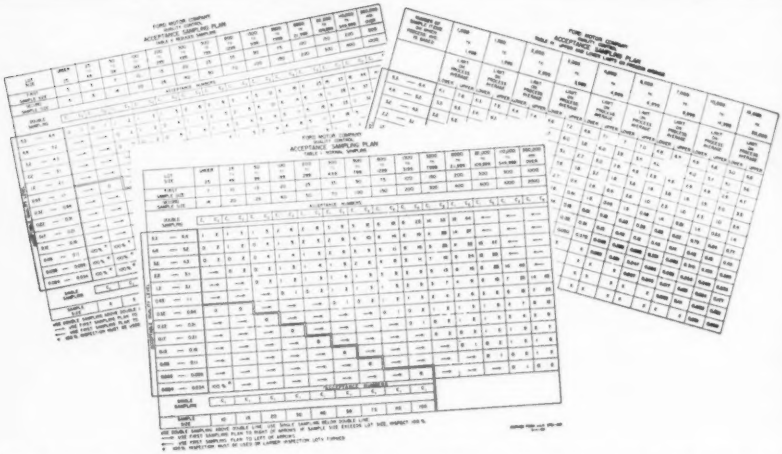

These sampling inspection tables for normal sampling, reduced sampling, and upper and lower limits on process average, are derived from Joint Army Navy Standard No. 105.

agreement recognizes a practical quality level—one acceptable to the buyer and attainable by the vendor.

A thoughtfully conceived quality level certification program, properly implemented, can go a long way toward reducing overall costs and improving overall quality in a finished product. When a shipment is rejected, no matter what the cause, it not only costs the vendor money to take it back, but it is also expensive for the buyer. It represents waste motion, extra paper work, possibly even curtailed production if the production schedule is affected by the rejection. This unwarranted additional expense must eventually become a part of the production cost.

Quality level certification permits a better utilization of manpower at receiving inspection stations. It reduces scrap and rework losses for both vendor and buyer, and thus helps promote a good vendor-buyer relationship. There will still be occasions when a shipment has to be rejected, but, because certification requires correlation of inspection methods between vendor and buyer, any rejection is based upon common measurement and knowledge previously agreed upon.

What are the basic requirements of certification? **Our experience shows that the vendor must have a working application of Quality Control, from his receiving department through every process to the final assembly.**

Furthermore, the buyer must have adequate receiving inspection facilities to enable him to check, or audit, the ability of the vendor to certify the quality level of his shipments. Successful quality level certification depends to a great extent on the faith the buyer has in the integrity of the vendor. However, gages have been known to go unaccountably wrong; human beings are subject to error; and a system by which two independent groups of people appraise a situation provides an extra precaution in safeguarding quality. For that reason, in our experience, both buyer and vendor agree that the audit is a necessary basic requirement.

Once a Statistical Quality Control program is solidly established by a vendor, and its working application verified through a visit by a Quality Control representative of the buyer to the vendor's plant, quality level certification is a logical next move, and can be discussed. A meeting is called with the vendor. A

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SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

QUALITY CERTIFICATION AGREEMENT. All terms of Quality Level Certification agreed upon by vendor and buyer are stated in this Quality Certification Agreement.

standard inspection procedure is developed and tentatively agreed upon.

Agreement upon this standard inspection procedure involves several steps. First, the specifications which vitally affect the quality of the part must be selected and established as the common standard of measurement for both parties. These specifications may include dimensional characteristics and the tolerances involved, as well as visual and functional characteristics. For some parts there may be literally hundreds of specifications on the original blueprints, but comparatively few of these may actually have any affect on the quality of the product.

Both vendor and buyer must realistically appraise the role of each specification, and in the end produce a workable, practical set of specifications that can be reasonably checked by the inspection organization of both, and have a definite bearing on quality.

A deviation from specification constitutes a defect, and the next step is to classify the seriousness of the defect, according to its effect on the quality of the part. A good practice is to classify defects into categories such as critical, major and minor.

The critical group should include all deviations which would result in functional failure of the article being manufactured and constitute a safety hazard. The major group should include deviations on which scrap and rework would be costly, and would appreciably affect the proper function of the article. The minor group should include deviations that do not result in expensive scrap or rework and do not involve possibility of failure.

A very important step in the establishment of this standard inspection procedure involves the selection of gages to be used by both parties. If possible, it is recommended that identical gages be used. Identical gages are not absolutely necessary, but it will minimize the possibility of error and consequent disagreement. If gages manufactured by different companies are used, they must be closely correlated.

Regardless of any inspections the vendor may perform during manufacture, a final sampling inspection according to a statistically valid sampling plan must be made before the goods are shipped. This inspection may be by lot, by hourly production, or by shipment, but its importance cannot be overemphasized. It is the only valid appraisal on which the vendor can base his written certification statement of quality. The numerical re-

(Continued on page 93)

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Precision centerless ground and polished; free of decarb.

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Thickness	.001" + or −
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SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

QUALITY
Measuring - Testing - Inspection
CONTROL

Statistical Sampling Inspection in Aircraft Parts Industry

One of the most valuable sets of tools that Statistical Quality Control has provided for industry is the variety of statistical sampling acceptance tables for inspection. Thus far, numerous tables have been developed, each set introducing new symbols and new quality protection definitions. Basically, they all have the same purpose which is to guarantee protection against passing defective products through inspection.

by **W. H. Coughlin**

Tapco Quality Control Engineer
Thompson Products, Inc.
Cleveland 17, Ohio

To the author's knowledge, the first statistical tables for industrial inspection were developed in the Bell Telephone Laboratories in 1926 by Mr. H. F. Dodge and Mr. H. G. Romig. These tables, probably the most widely used in industry today, are known as the A.O.Q.L. and Lot Tolerance single and double sampling tables.

The outstanding feature of the Dodge-Romig Tables is that they are based on the minimum amount of over-all inspection and consequently they result in the minimum inspection cost. Because of this feature and their simplicity of interpretation these tables are, in general, the best suited for industrial inspection.

Other tables have been developed by H. F. Dodge, one of which is "A Sampling Inspection Plan For Continuous Production". This sampling plan is ideal for the inspection of product moving along a conveyerized process. It is especially applicable to industrial inspection in that it is flexible to the extent that practically any first sample size may be used.

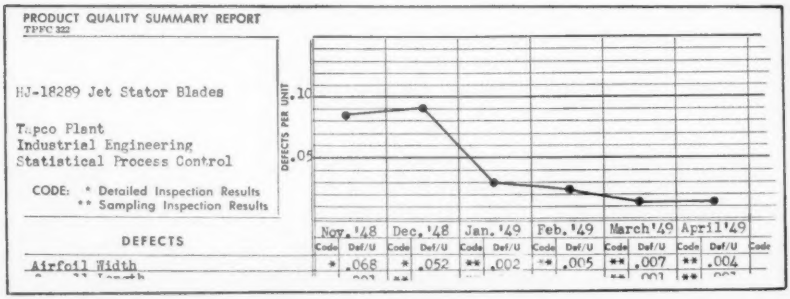
Another outstanding benefit of this plan is that 100% inspections can be performed as a result of the sampling criteria without holding back sub-lots of product. This is possible, because the 100% inspections are performed on the product reaching the inspection station at and after the time at which a defect appears in the inspection sample.

Three fundamental characteristics of the Dodge-Romig Sampling Tables are referred to by the symbols **A.O.Q.L.**, p_t and **I.** These three terms are somewhat easy for the laymen to understand and may be described as follows:

A.O.Q.L.=Average Outgoing Quality Limit. The maximum average per cent defective in product after inspection.

p_t =Lot Tolerance Per Cent Defective. The per cent defective in a sub-lot of product that may be accepted by the sampling plan one in ten times providing a sufficient number of lots of such a

Fig. 1. This monthly Products Quality Summary Report keeps Management, Engineering and Shop Supervision informed on current quality levels.



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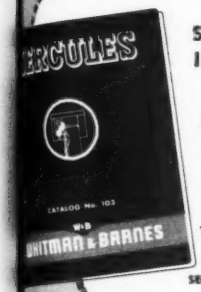
Whitman & Barnes Hercules type die buttons are made from a selected grade of oil hardening tool steel. They are hardened and precision ground in the most modern cutting tool plant in the world. The taper relief found in both types, Interchangeable and Press fit, will clear all slugs and still maintain regrind life. Outside and inside diameters are guaranteed concentric. A new feature on the Press fit type, is the 3/16" lead on the outside diameter which insures a straight and accurate start when die button is pressed into position.

LIST NO. 750
Interchangeable type—outside diameter ground to fit W&B Hercules Punch retainers.

LIST NO. 760
Press fit type—standard diameters to fit your plates or holders.



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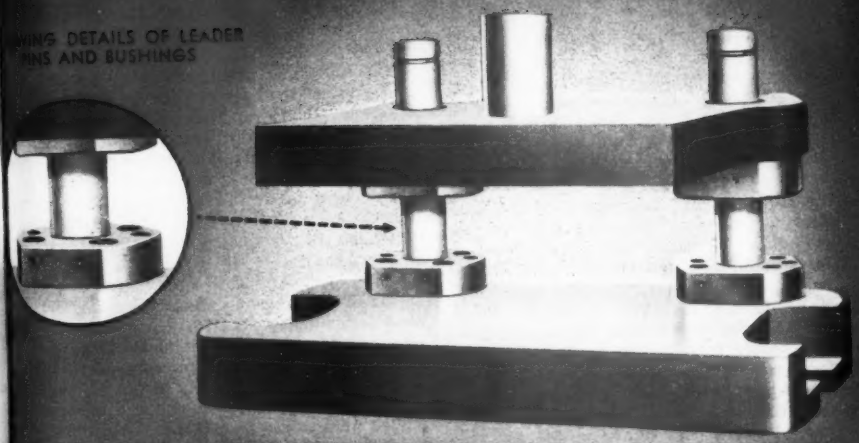
MANUFACTURING CONTROL CHART

TYPE NO. HT-18289	PART NAME STATOR BLADE	SKETCH NO	OPERATION NO. 370	DEPT. NO. 433	GAGE NO 86-4110	CHART NO 2
B/P DIMS .850 ± .005	CHARACTERISTIC AIRFOIL WIDTH	MATERIAL ES 72880	MACHINE TYPE FITCHBURG GRINDER			MACHINE NO 70041-3-19
SAMPLE SIZE 5	REMARKS ALL MEASUREMENTS ARE RECORDED IN THOUSANDTHS OF AN INCH FROM .850"					

| | 1-9 | | | | | |

NO OTHER DIE SETS LIKE BAUMBACH

WING DETAILS OF LEADER
INS AND BUSHINGS



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PLANT
NO. 1

Because of the patented demountable leader pins and bushings which are hardened, ground and super finished for accuracy and durability.

Baumbach precision built die sets have been serving industry for 40 years and through better quality and prompt service has become the foremost producer of die sets.

An important advantage of Baumbach die sets is our method of fastening the leader pins and bushings to the die shoes and punch holder. Other cost cutting features are the ease of regrinding, counterboring or machining. No leader pins in your way.

Write for catalog B-50. It contains much valuable information about die sets.

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Fig. 2. The data shown above for January 9th is part of the study made by

AL

per cent defective are submitted for inspection.

I=The Average Overall Amount of Inspection. This is the amount of product that will be both sample inspected and 100% inspected as a result of the sampling acceptance criteria.

The following presentation will illustrate by an actual case history a method of installing and revising Dodge-Romig Sampling plans.

The monthly Product Quality Summary Report shown in Figure 1 is the general type of report used at Thompson Products to keep management, engineering, and shop supervision informed of current quality levels. This particular report was started in November, 1948 to analyze the quality records for a type of Jet Stator Blade. Since two or more types of defects may appear on the same blade, the quality levels are shown in terms of defects per unit.

This method of auditing the defectiveness of product provides an over-all evaluation of quality for a given product in terms of total defects per unit; whereas, if per cent defective values were used, it would not be mathematically correct to show the total of the per cent defective values for a given product. The defects per unit value for any one item on the report can be converted to per cent defective by moving the decimal point two places to the right.

Preparation of the Product Quality Summary Report evidenced the need for better control of the airfoil width which was running at 6.8% defective. The airfoil width is the actual width of the blade under discussion and was brought into size on a Fitchburg grinder.

The first step in the investigation of the trouble was to establish a study control chart for averages and ranges at the grinding operation. The data shown for January 9th on the control chart in Figure 2, is a portion of the study made on one Fitchburg grinder.

As often is the case, this study control chart speaks for itself in depicting the radical changes made in machine settings as indicated by the changes in level on the chart for averages. However, notice that the control chart for ranges shows excellent control, and therefore, can be used to estimate the capability of the grinding machine.

The data recorded on the control chart for January 24 and January 25, indicates that the machine settings are more uniform for each operator and between operators. Notice also, that the machine settings are centered somewhat closer to the blueprint nominal dimension.

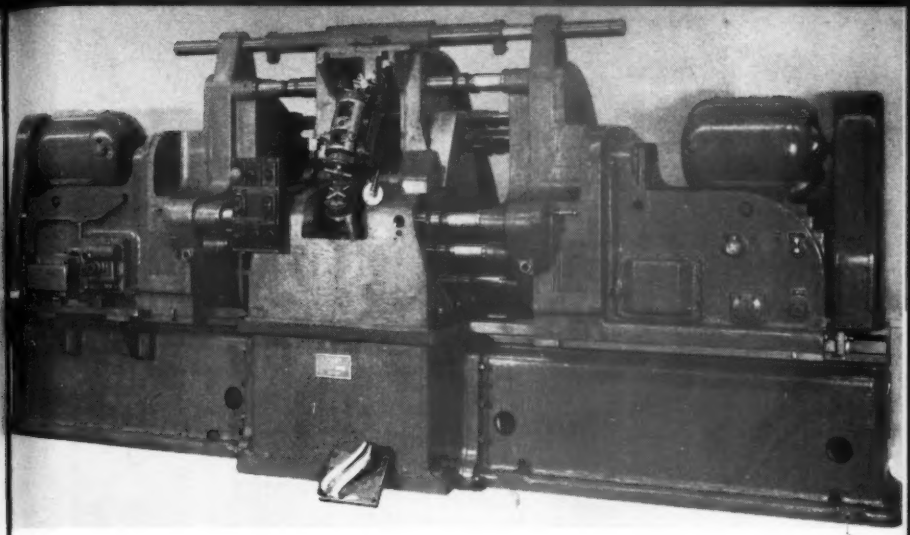
The type of control limits used in this case are known as reject limits. They differ from the normal control limits for averages in that they allow the highest and lowest machine settings attendant upon producing all of the individual pieces within the blueprint limits. A detailed explanation of the computation and use of reject limits appears on page 215 in **Statistical Quality Control** by E. L. Grant, McGraw-Hill Book Company.

The application of this control chart took immediate effect on the quality of the subject blade and caused the defects per unit value for airfoil width to drop to .002 (.2% defective) in the January entry on the Product Quality Summary Report, Figure 1.

Since airfoil width was reduced to such a low per cent defective value, the next logical step was to change the inspection for this characteristic from a 100% inspection to a sampling inspection. Careful consideration was given to the seriousness of this defect and it was concluded that a 1.0% A.O.Q.L. would not be damaging to the product in the field.

The Dodge-Romig 1.0% A.O.Q.L. Double Sampling Plan was immediately adopted for this inspection because the lots of product were shipped to the inspection area in trays and some sort of lot-by-lot sampling acceptance plan was needed. Under these conditions, this sampling plan would require the minimum amount of over-all inspection and would be easy for the inspector to learn to use. The plan is shown in Figure 3.

The plan under discussion is "Layout No. 21, Issue 1" and shows all of the information pertinent to the issuance of the plan, the use of a plan, and the keeping of its associated records; namely, the product to be inspected, the date of issue, the source of material, the inspection department number, the sampling table, the inspection operations, an approximation of the output, the usual lot



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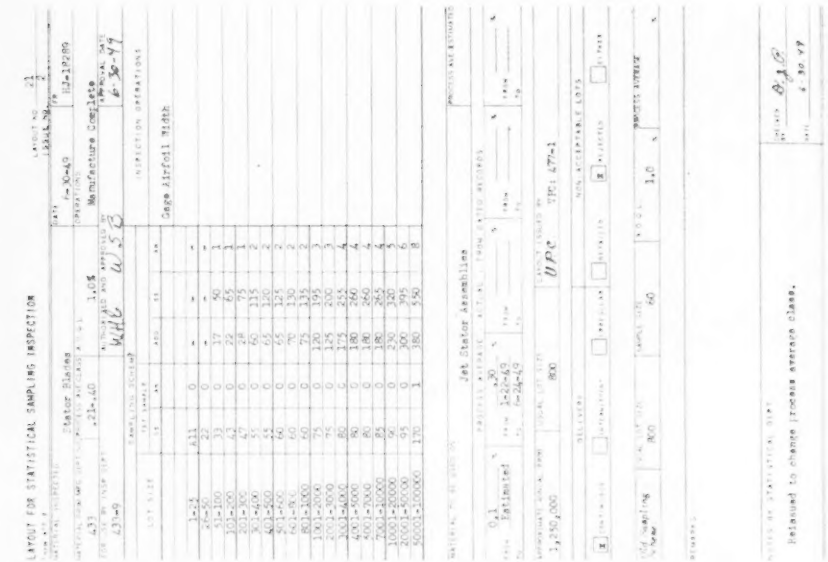

Fig. 3. This chart, based on the Dodge-Romig 1.0% A.O.Q.L. Double Sampling Plan which minimizes over-all inspection and is easy to use, shows all information pertinent to the plan.

size, the delivery of the lots, the disposition of non-acceptable lots and the latest process average per cent defective for the characteristic to be sample inspected.

The Inspector's Quality Report, Figure 4, illustrates how the sampling plan is used. For example, lot No. 8 contained 800 pieces. Entering the sampling table at lot size 601-800, a first sample of 60 pieces is specified. If zero defectives are found in the first sample, the lot is passed. However, one defective was found in this sample, and therefore, an additional sample of 70 pieces was drawn from the lot, making a total sample of 130 pieces.

The plan allows two defectives in the total sample. If more than two defectives are found, the lot is rejected to the manufacturing department for detailing (100% inspection), as in the case of lot number 16. If three or more defectives were found in the first sample, the lot would be rejected immediately upon the completion of the inspection of the first sample.

The first sample should always be completely inspected so as not to bias the process average per cent defective computed from first sample results. If, however, the total allowable number of defectives is exceeded during the inspection of the second sample, the sampling inspection is discontinued without completing the second sample and the lot is rejected for detailing.

The letters P, R, or D in Column 11 are abbreviations for the terms: passed, rejected, and detailed. If the letter P appears in column 11, the lot was passed, if the letter R appears, the lot was rejected to the source for detailing, and if the letter D appears, the lot was detailed by the inspecting organization.

It is suggested that, whenever possible, non-acceptable lots should be rejected to the manufacturing department; this provides an incentive for better quality. Almost the same effect can be attained by charging the cost of such detailed inspections to the manufacturing department in cases where the rejection of

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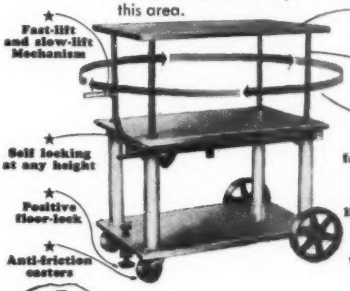
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SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

INSPECTOR'S QUALITY REPORT

Form 477-6 TPM

WEEK ENDING Date 2-12-49

NAME OF INSPECTOR — INSPECTOR'S No. — GROUP 438-9 SHIFT 3 SHIFTS SUPERVISOR'S APPROVAL W.F. L.W.

(1)	(2) MATERIAL CODE	(3) MATERIAL DESCRIPTION	(4) LOT SIZE	(5) FIRST SAMPLE SAMPLE SIZE	(6) FIRST SAMPLE DEFECTIVES	(7) FIRST PLUS SECOND TOTAL SAMPLE	(8) FIRST PLUS SECOND DEFECTIVES	(9) DETAILED INSPECTION TOTAL INSPECTED	(10) DETAILED INSPECTION TOTAL DEFECTIVES	(11) P, R, OR D	(12) SAMPLE LAYOUT No.
1	18289	BLADE	800	60	0					P	21
2	"	"	750	60	0					P	"
3	"	"	610	60	0					P	"
4	"	"	690	60	0					P	"
5	"	"	785	60	0					P	"
6	"	"	780	60	0					P	"
7	"	"	200	43	0					P	"
8	"	"	800	60	1	130	2			P	"
9	"	"	700	60	0					P	"
10	"	"	710	60	0					P	"
11	"	"	710	60	0					P	"
12	"	"	710	60	0					P	"
13	"	"	690	60	0					P	"
14	"	"	780	60	0					P	"
15	"	"	780	60	0					P	"
16	"	"	800	60	2	130	3	800	15	R#8	"
17	"	"	800	60	0					R#8	"
18	"	"	800	60	0					P	"
19	"	"	800	60	0					P	"
20	"	"	800	60	0					P	"
21	"	"	800	60	0					P	"
22	"	"	800	60	0					P	"
23	"	"	800	60	0					P	"
24	"	"	800	60	0					P	"
25	"	"	800	60	0					P	"
26	"	"	800	60	0					P	"
27	"	"	800	60	0					P	"
28	"	"	800	60	0					P	"
29	"	"	750	60	0					P	"
30	"	"	750	60	1	130	1			P	"
31	"	"	720	60	0					P	"
32	"	"	640	60	0					P	"
33	"	"	770	60	0					P	"
34	"	"	770	60	0					P	"
35	"	"	800	60	0					P	"
36											
37	TOTALS		25295	2023	4	2233		800			

Fig. 4. This Inspector's Quality Report form shows how the Sampling Plan is used.

lots may be cumbersome.

Notice that lot number 16 was rejected and assigned rejection number 8, returned for reinspection as the 17th lot of the week, and passed on the second inspection. The records pertinent to the second inspection are encircled on the Inspector's Quality Report, Figure 4, to indicate that they should not be used in the computation of the process average per cent defective, since the lot has already been accounted for and by no means is representative of the process after it has been detailed.

The same table that was used to reject the lot is used to determine the sample size when the lot is returned for reinspection, but the allowable number of defectives in the sample is always zero. This is reasonable, since it is highly improbable that a defect would occur in a sample drawn from a lot that has been detailed.

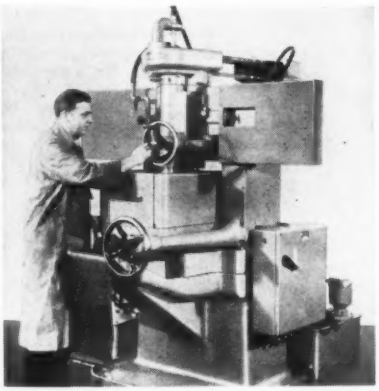
Actually, if defects are occurring in the samples selected from returned lots, one of two conditions exist, either the lots are being returned for reinspection without being detailed in hope of slipping them through the second time, or the method of detailing is inadequate.

Records such as those in Figure 4, are kept for two purposes: to provide a check on the use of the sampling table and to provide a means for computing the current process average per cent defective.

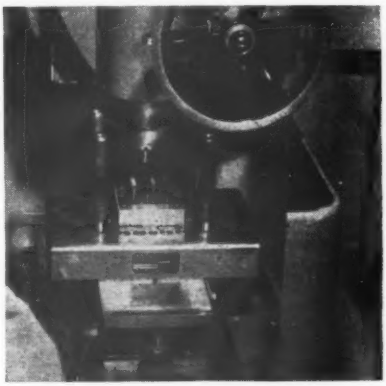
(Continued next month)

Pratt & Whitney Machine Developments Contribute to Tool Quality

The new Pratt & Whitney Keller "BL" tracer-controlled milling machine, illustrated above, incorporates many new features destined to substantially reduce the number of machining hours required to produce dies, molds, experimental parts and irregularly shaped pieces. New automatic electric tracer control has been developed which enables the tracer to travel smoothly over any contour 2 to 3 times faster on finishing operations, and, in conjunction with an automatic variable speed control, provides continuous variation of the individual machine motions (called for by the tracer) in proportion to the slope being followed. By means of a power limiting circuit, the cutter is allowed to take power up to, but not beyond, the greatest load it can handle safely without breaking. Non-cutting time is eliminated by automatically reversing either vertical or horizontal travel at the edge of an irregular form or cavity rather than at a fixed length of travel.



The lower left illustration is of Pratt & Whitney's new grinder for surfacing high speed steel and carbide dies. Although specifically designed for facing new die blocks, reconditioning worn cutting edges, and preparing worn dies for



resinking, it is equally suitable for regular surface grinding.

Operating like a vertical profiler (see close-up of working position, above), it readily finishes flats around irregular reliefs and also produces precision step grinding. Surface finishes of 1½ to 2 micro inch are produced without need for subsequent lapping or polishing. Generous clearance permits grinding between guide pins on blanking punch and die halves, thus saving much dismantling and reassembly time. A constant flood of coolant is supplied to both the inside and outside of the wheel.

Q-C Convention News:

"Quality Control, Today's Foundation for Tomorrow's Reputation"

is the theme of the American Society for Quality Control's fifth annual convention to be held in Cleveland, Ohio, May 23rd and 24th, 1951.

The phenomenal growth of this Society is an index of the practicability of quality control by statistical methods. The relatively new organization was founded in 1946. Its membership of 4000 is composed of persons from a wide range of industries in the United States and Canada.

Its purpose is to promote interest in the advancement and diffusion of knowledge of the science of quality control and of its application to industrial processes. The annual conventions provide one of the more effective means for achieving this purpose.

The Convention Committee, under the general chairmanship of the Society's president, Wade R. Weaver, Republic Steel Corporation, Cleveland, already has formulated plans for this event. Convention headquarters will be located at the Hotel Cleveland. The clinics and training sessions will be held at the Cleveland Public Auditorium.

Some exhibit space will be devoted t displays by manufacturers of gages and testing equipment used in quality control work. Other exhibits will illustrate examples of applications by manufacturers utilizing quality control techniques in the processing and inspection of their products. It is expected that several thousand people will evidence active interest at this convention.

The theme of the convention, "Quality Control, Today's Foundation for Tomorrow's Reputation," is to be highlighted in keynote addresses by several industrial leaders. Several series of clinics are planned to presen discussions on applications of quality control in diverse industries; however, one series will be devoted to the more technical aspects of the use of statistical methods. The training sessions will constitute a condensed course in quality control for those desiring basic training under highly competent authorities on the subject.

A comprehensive program of interest to practically all levels of development has been arranged. While it is virtually impossible to cover all fields, the speakers selected and their subjects will cover

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those areas most under discussion today. General areas covered by the papers to be presented, and the corresponding fields of interest, are as follows:

CHEMICAL INDUSTRIES

Applications of Statistics to Chemical Problems in Industry

Designed for those in chemical industries interested in frontiers of statistical application.

Application of Statistics in Pharmaceutical Manufacture

For those interested in statistical devices and peculiar problems of pharmaceutical manufacture.

ELECTRONICS INDUSTRY

Product Reliability and Consumer - Vendor Relations

Will be of interest to all involved in Consumer-Vendor relationships.

Round Table Discussion of the Preceding Presentations

Audience participation in developing the broad field of Consumer-Vendor relations.

AUTOMOTIVE INDUSTRY

Quality Control in Manufacture of Parts and Sub-Assemblies

For all interested in the use of Quality Control techniques in precision manufacturing.

METAL AND METALWORKING

Quality Control at Work in Steel Processing

For those who wish to hear applications of control procedures and analysis.

Quality Control in the Foundry

Designed to show that these techniques can be applied in the foundry.

Quality Control Applications in Metal Processing

Covering the fertile fields of stamping, forging and heat-treating.

MATHEMATICAL STATISTICS

Statistics in the Service of Quality Control

Designed for those with considerable background, and others willing to accept some statistics in order to enjoy those speakers.

GENERAL INTEREST

Quality Control in the Non-Metallic Field

Receiving Inspection

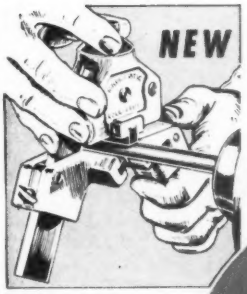
Two Statistical Techniques: Significance Tests and Analysis of Variance

Factory Applications

Marketing Aspects; Industrial Engineering Phases; Production Management Fields

The Armed Services' Use of Acceptance Sampling

Where Quality Control Belongs



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experience would stand them in good stead but the background necessary for the Quality Control Engineer will rarely be found in the shop.

The supervisor who staffs his quality control group from the shop will sooner or later be faced with a very knotty situation where he has a group on his hands which has done a fine job for a year or so but which obviously reached the limit of its ability and the expectations of the job have gone well past what can be reasonably expected from the men.

In other words, the job has outgrown the men and nothing can be done about it except to gracefully and gradually transfer these men into positions more in line with their ability. During this process, the progress of the quality control program must inevitably slow down.

Prudence dictates that minimum educational requirements be set up, that candidates for the position or positions be found who meet these requirements, and the men chosen whose personal characteristics are best. The Quality Control Engineer must be an engineering graduate, chemical, mechanical, or electrical, depending on the nature of the company's operations and products. For a punch press department or machine shop, a mechanical engineer is best. For a plastic molding department either a chemical or mechanical engineer would be suitable. Many assembly departments require an electrical engineer.

If an engineer is taken from some other job within the company, he should be well above the average company engineer. If a man is chosen right from a graduating class he should be in the top 25% of the class.

A very excellent guide to prediction of what a man will do in quality control work is his Otis test score (I. Q.). The range 125-145 is best. Those below 125 will be slow in learning and applying the techniques while those over 145 might outgrow the job too rapidly.

Several personal characteristics are important because of the high frequency and varying levels of personal contacts which the Quality Control Engineer encounters in his normal course of work. Foremost among these are a pleasing personality, maturity of outlook, a definite tendency toward diplomacy and tactfulness, the ability to be firm when necessary, and a full measure of ambition.

For every ten engineers in the quality control group there should be a full fledged statistician or mathematician with a master's degree. These men serve well as technical advisors and are very valuable to the engineers as sources of information on statistical techniques. These are the men who will solve the very knotty problems involving quite advanced techniques which will invariably be brought to the quality control group.

Admittedly it is difficult to find men who fit these requirements but it can be done and diligence and patience in selection of personnel brings rich returns.

When it comes to deciding how many Quality Control Engineers a company will need when it is fully staffed, there are a few things which should be considered. Every operating department, both Pieceparts and Assembly, should have a Quality Control Engineer attached to it. The Receiving and Receiving Inspection departments should also have a man.

Depending on the size, location, and nature of these departments, one engineer may be able to effectively service more than one department. If a department is of all the same type of operations such as a machine shop, punch press department, a painting department, or one assembly department, a quality control engineer should be able to handle a department comprising as many as 500 people.

Where operations are diversified, probably one quality control engineer would do well to cover 200 people. For the average plant a good estimate of necessary personnel would be one supervisor, one engineer for every 300-400 factory employees, and a statistician or mathematician for every ten engineers.

Results Expected

Rather than paint the rosy picture of tremendous cost reductions in scrap, salvage, and inspection costs, it might be better if a few areas in which both

(Continued on page 130)

We would like to point out

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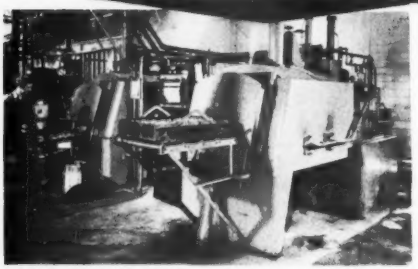

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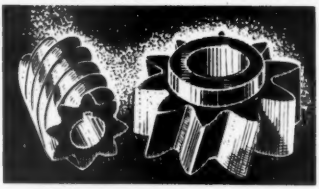

TO YOUR SPECIFICATIONS

" Gears are Our Business"

Our equipment, our skilled personnel—our entire output is geared to your order.

We shall be pleased to have you submit a part or print for our quotation—no obligation.

SKIDMORE GEAR CO.

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Electrolizing

means PROTECTION *against* WEAR *and* CORROSION

USERS REPORT:*

. . . 50,000 Pieces to 350,000"

"Your process of *Electrolizing* our tools, dies, pins and rollers has so increased wear resistance we are going to have you process all of our dies, et cetera. We have increased production runs from 50,000 pieces to 350,000 pieces between grinds on some dies."

. . . 800% Increase

"800% increase in hob life working cast iron....."

. . . 1200% Increase

"*Electrolizing* index cam gave 1200% increase in life..."

. . . Stepped up to 80%

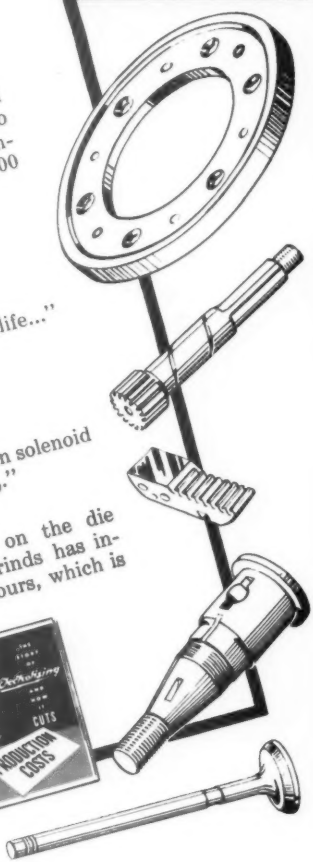
"Pump efficiency stepped up from 70% to 80%..."

. . . Voltage Input Reduced by 33%

"Reduction in friction, provided by *Electrolizing* on solenoid valve, enabled us to reduce voltage input by 33%."

. . . 7 Hours to 16 Hours"

"We have completed four production runs on the die which you *Electrolized*. The time between grinds has increased from about seven hours to sixteen hours, which is a very satisfying improvement."



WRITE TODAY for your copy of "The Story of Electrolizing and How It Cuts Production Costs."

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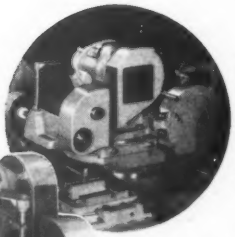
MEEHANITE CAST IRON STEEL BRIDGES THE GAP

Eliminate
COSTLY SET-UPS!



External grinding spindle on double-end universal wheelhead.

with RIVETT'S
TRULY UNIVERSAL HYDRAULIC GRINDER

FEATURES
of a Truly Universal Grinder

1 — Internal spindles for small, large and deep hole grinding — speeds from 6,000 to 35,000 R.P.M.
2 — External spindle has double-row roller bearings for radial load and ball bearings for end thrust.
3 — Lathe-type workhead spindle mounts draw-in collets and step chucks directly.
4 — Micrometer table stop and fine feed for shoulder and blind hole grinding.

Set-up time is reduced to the barest minimum on the new 1024 Rivett with the truly universal wheelhead. Mounting both internal and external spindles and swiveling 180°, it handles both types of grinding with equal mastery — changes to either work in seconds.

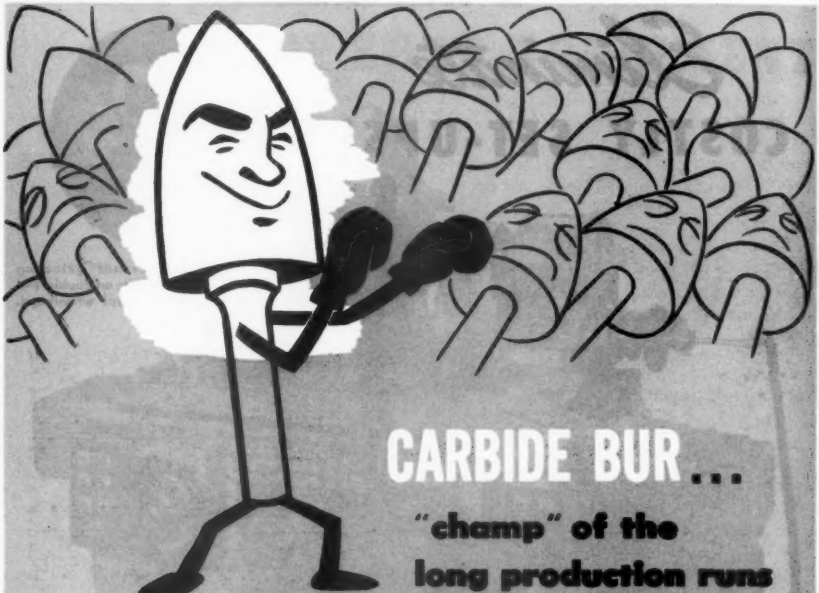
Write for Bulletin No. 1024A.

RIVETT

LATHE & GRINDER, Inc.
Dept. TJR 10 *Brighton 35, Boston, Mass.*

For More Precision Work *RELY ON RIVETT LATHES AND GRINDERS*, The Master Craftsman's Master Tools

SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS



CARBIDE BUR...

"champ" of the long production runs

Carbide Bur is a "champ" if there ever was one! But there's also something to be said for the "trainer"—Nicholson. A developer of star performers among files of all types, Nicholson has brought to a high degree of perfection the grinding of power-driven burs from Tungsten Carbide . . . to win the drawn-out battles of long production runs.

Nicholson Carbides have up to *one hundred times* the lasting qualities of High Speed Steel. Their true peripheries and precision-centered shanks enable running them at high speeds and light pressure . . . consequently making their seemingly high first cost comparatively low. The resharpening service Nicholson offers cuts their cost still further.

Now available through your industrial distributor in ⅛" shanks (12 shapes) as well as ¼" shanks (9 shapes, medium and fine cuts). CATALOG, including useful technical information, on requests sent direct to us.

NICHOLSON FILE COMPANY
95 ACORN STREET PROVIDENCE 1, R. I.
(In Canada, Port Hope, Ont.)

NICHOLSON ROTARY FILES
HAND CUT AND GROUND-FROM-SOLID • CARBIDE AND HIGH SPEED STEEL

NICHOLSON U.S.A.

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

Hydraulic Tracer Control Simplifies Contouring and Profiling on Standard Boring Mills

In these times of constantly rising costs the installation of more productive equipment seems the only answer to profitable operation. Many plants are showing remarkable savings by extending the versatility of their standard machine tools by equipping them with hydraulic duplicating attachments.

This article deals with a proved method of quality control and increased production for horizontal boring mills equipped with duplicating controls as manufactured by the Turchan Follower Machine Company of Detroit.

The large boring mill which is usually the most expensive piece of equipment in die shops should have the widest possible range of uses so that it can produce to fullest advantage.

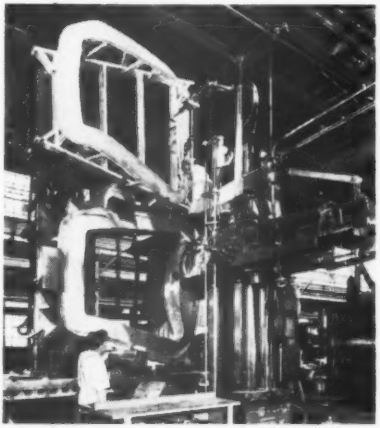
Standard boring mills can be easily converted to do contouring and profiling, with a master model or pattern substituted for the blueprint, and a sensitive tracer-actuated feed control mechanism substituted for the operator's manual skill. The attachment does not interfere in any way with the standard operation of the machine, as it is only a matter of switching a couple of handles to revert to ordinary controls.

Precision follower control which provides a smooth, uniform power feed for both the cutting tool and the work, allows the duplication of irregular shapes to be readily obtained as accurately as straight machining; contouring and profiling with equal facility in exact conformance to the master pattern.

In the application illustrated, machining an auto body die in duplication of a plaster master model by means of Turchan control, the work is done with a minimum of effort on the operator's part. Engaging the follower takes only a few minutes, and it can be disengaged just as rapidly.

The Turchan tracer scans the master by means of the table power cross feed. The table and angle plates carry both the workpiece and the model. The in and out feed of the boring mill spindle and cutter is accomplished by cylinder tracer controlled movements.

The vertical movement of the head stock and longitudinal movement of the table (or column if floor type machine) is obtained through the existing lead screws which are driven by tracer controlled fluid motors. The motors are engaged and disengaged by a change-over valve which throws the driving clutch into contact as directed.



Speed and accuracy are attained in profiling and contouring this large auto body die on a standard boring mill equipped with Turchan hydraulic tracer control. The centralized portable control panel simplifies operator's work in guiding cycle of operation.

This equipment employs a hydraulic power system which is ideal from the standpoint of positive drive, freedom from lost motion and backlash, and is accurately responsive to the control dictated by the variations in the master pattern.

All controls in the set-up illustrated are operated from a centralized control panel which is fully portable and can be placed in any location to suit the opera-

(Continued on page 92)

QUALITY
Measuring - Testing - Inspection
CONTROL

Quality Control in Carbide Tools Manufacture

The problem of quality and its control is two-fold. Not only must excellent quality be assured, but it must be secured at a reasonable cost. The old conception of producing material on a hit-or-miss basis and then separating the wheat from the chaff has no place in today's picture. To be sure, a certain amount of material will always be carried to completion before the discovery of unacceptable defectiveness is made, but such cases should and must be in the minority. By far the greatest portion of defective material can be detected and eliminated at an intermediate stage in processing, where such elimination represents the least possible loss to the manufacturer. The methods employed for this early discovery of defectiveness are known as "In-process Inspection."

by **David F. Dickey**, *Supt.*
Quality Control Department
Firth Sterling Steel & Carbide Corporation

At Firth Sterling, this early discovery of defective material, however, is not enough to meet the ultimate goal of consistent high quality in the finished stage of the products. The only true method of controlling quality lies in the continuous perfection of methods which will lead to the anticipation of manufacturing conditions that give rise to defectiveness. Methods of this type are being developed and used by an increasing number of companies throughout the country today. Collectively, these methods are known as Statistical Quality Control, and they represent a completely new conception of manufacturing control. By means of Statistical Quality Control it is possible to assign causes for defectiveness, and thus to anticipate and to prevent defects in the products.

The effectiveness of any of the new Statistical Control methods is subject to many conditions. First of all, the raw materials must be of such quality that they can be successfully converted to an acceptable product. This can be assured by:

1. Specifications which will completely cover the necessary requirements and attributes of the raw materials;

2. Development of specific tests to provide a means of checking the raw materials for compliance with the applicable specifications;

3. Adequate equipment and personnel, available at the right places to perform these tests;

4. Full and accurate use of the prescribed tests.

After good raw materials have been established, the next step is manufacturing operations control:

1. Machines and processes must be so fully developed and standardized that these good raw materials will be converted each and every time into good products. Not only must they be good products, but they must be uniform products. The customer bases his opinion of the quality of any shipment on the standard of the best shipment he has received, and any failure on the part of the manufacturer to maintain a uniformly high standard jeopardizes his reputation with that customer.

2. Personnel must be sufficiently well trained and sufficiently familiar with correct operating practice to take full advantage of the materials and machines under their control;

3. Inspection methods must prove that a standard product has, in reality, been produced.

4. That standard product must satisfy the individual customer and fulfill his requirements.

These factors are all requirements for a reputation of good quality, and they are the chief concern of the Quality Control Department. However, they are not and cannot be the sole responsibility of that department. They must represent the united efforts of each individual group and department throughout the company. The real function of the Quali-

(Continued on page 94)

Zeiss Optical Tools

The Ercona Corporation of New York has been appointed exclusive American agents for the entire line of Carl Zeiss, Jena, industrial and scientific optical instruments, binoculars and photographic lenses. A scientific instrument division has been set up under the direction of Alfred Boch, long experienced in the precision optical field. Associated with E. Leitz of Wetzlar for over 28 years, Mr. Boch was Vice-President in charge of imports and sales in the E. Leitz New York office, and also held executive posts in the Vienna and London branches of the same company. He is a Fellow of the Royal Microscopical Society.

The Carl Zeiss plants in Jena are reportedly once more turning out precision instruments in a volume comparable to that of pre-war production. This includes a broad range of instruments now available for science and industry in America. Inquiries as to particular requirements should be addressed to The Scientific Instrument Division, Ercona Corporation, 527 Fifth Avenue, New York 17, N. Y.

A HUNDRED JIGS IN ONE

with CARDINAL SPEED VISE

EXCLUSIVE FEATURES

1. Saves time—one hand operation—"lift, slide, lock!"
2. Saves tooling expense—smaller, simpler jigs.
3. Saves space in tool crib.
4. Indispensable for toolroom work in addition to production.

SPEED VISE SOLD ONLY THROUGH RECOGNIZED DISTRIBUTORS.

new literature available

CARDINAL MACHINE COMPANY
GLENDALE, CALIFORNIA

. . . . . Tracer Control

tor's convenience. The push buttons are placed in a convenient sequence of operation, with a signal light showing the exact station the unit is working in at all times. This control panel makes it possible for the operator to position the milling head wherever desired by merely pushing buttons.

The cycle of operation can be started or stopped as desired. Any position can be quickly obtained by passing over any portion of the cycle not required, thus eliminating any lost or excessive travel time when not actually in a milling operation.

The hydraulic duplicating equipment as applied to boring mills gives the machine flexibility and versatility that becomes particularly useful in the machining of large parts where handling of the massive workpiece can be kept to minimum. In addition to time saved, the Turchan method reproduces the master model to extremely close limits, in the order of one to three thousandths of an inch, depending on the nature of the job.

The fact that ordinary boring mills can be converted to contouring and profiling results in a broader scope of work the shop can quote on, which in turn, should substantially increase income. Also there are many jobs not being produced by tracer-controlled movements that could be produced better and faster if tracer equipment were applied.

* * * * *

A. E. Tozer Buys Tungsten Carbide Tool Company

Sale of Tungsten Carbide Tool Company, Detroit, by Michigan Tool Company, to A. E. Tozer, general manager of the company since its founding, has been announced.

Tungsten Carbide Tool Company was one of the first in the United States to produce carbide-tipped tools, having been founded in 1928. It now produces both special and standard tools, ranging from single-point tools to milling cutters, etc.

The company recently moved into newly constructed quarters at 26250 West Seven Mile Road, Detroit.

Speedy Height Gage

The accurate and speedy Dickerman Height Gage can be used as a height

gage, comparator or scriber for a wide range of jobs. Its simple construction permits quick transferring from one job to another.

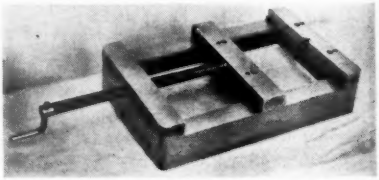
Design of the differential screw adjustment allows for practically no lost motion, and settings in the tenths of thousands are quickly and accurately attained because one revolution of the adjusting screw moves the sliding member less than .006".

Circle Inform-A-Gram No. D6.

* * * * *

Sturdy Drill Vise

Bay State Tool & Machine Co.'s new drill vise is a sturdy, lightweight workholder designed for fixtures, dies and similar parts that often require a good deal of drilling, reaming and tapping ordinarily done on a drill press and tapping machine.



Work is held firmly in hardened and ground stepped jaws. The vise can be readily converted for short or long run production jobs. Holes are provided on four sides for clamping the vise to a plate or machine bed.

Circle Inform-A-Gram No. D8.

. . . . . **Ford Motor**

sults of the sampling inspection are reported on that statement, which must be approved and signed by the Quality Control manager or some other responsible person.

The next step, therefore, in the establishment of a standard inspection procedure, is selection and agreement upon the standard sampling plan to be used, both in the vendor's final inspection, and in the buyer's audit. The most widely used sampling plans are "Single and Double Sampling" as developed by Dodge and Romig, Dorian Shainin's "Lot-Plot Method", "Sequential Analysis" by Wald, and "Sampling Inspection" by the Statistical Research Group, Columbia University.

The armed forces have adopted a standardized plan for their use known as "Joint Army-Navy Standard 105", or JAN Standard 105. The same sampling plan need not necessarily be used by both buyer and vendor, but if different ones are used, they must be correlated.

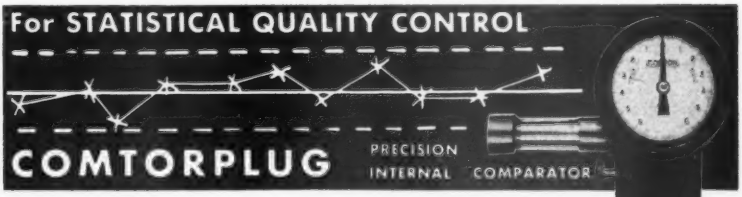
Another step is to set an acceptable quality level (called AQL) for each of the categories of defects which will govern acceptance or rejection of individual shipments. For example, the acceptable quality level (AQL) may be set at one-quarter of one per cent for major defects, since our system cannot tolerate very many of this type. For minor defects, however, the AQL may be set considerably higher and still not affect the quality of the end product. Critical defects, generally, cannot be permitted.

These AQL's are primarily determined by our needs, but must of necessity reflect a level which our suppliers can attain by reasonable and careful application. It should be pointed out that the AQL set for each category (major, minor, etc.) is for the **sum of all defectives** in that category.

Finally, we must make provision for the statistical data that is to be supplied by the vendor with each shipment, and we must agree on a period of time for correlating our data to assure all concerned that all requirements for certification can be and are being met. This correlation period not only tests the ability of the vendor to accomplish certification, but it also appraises the various steps in the certification process, such as the choosing of reasonable specifications and categories of defects, the agreement

(Continued on page 105)

For STATISTICAL QUALITY CONTROL



COMTORPLUG PRECISION INTERNAL COMPARATOR

Gages precision holes to fractions of .0001"

War production conditions intensify the need for a gage that gives high precision yet is Rugged, Automatically Accurate, "Unrestricted".

Patented COMTORPLUG answers the need as no other gage can because:

1) Withstands typical shop use at machine or inspection bench, without lessening precision.
2) Trainees equal old hands in precision results, due to automatic alignment and "feel".
3) For Quality Control, gives actual measurement, and a fixed—not passing—reading.
4) Available anywhere instantly. Weighs but a few ounces. No hose, wire, or "10-ton base".
5) Cost is so reasonable as to be practical for all quantity gaging applications. Fits in with other gaging methods. Let it grow as it proves itself—which it WILL!

1/8" to 8" dia.

Inspection to fractional ten-thousandths of hydramatic airplane propeller distributor valve.

COMTOR CO. 82 Farwell St., Waltham 64, Mass.

Request "Bulletin 40"

For data on COMTORGAGE Precision External Gage, request Bulletin 30.

. . . . . **Carbide Tools Q. C.**

ty Control Department is to co-ordinate the contribution of each group into an integrated, logical program. Technicians, equipment and industrial know-how must be marshalled in a concerted effort to produce the most in quality and quantity for the least cost, so that the manufacturer can continue to grow and expand to its rightful place in industry.

The conversion of even one operation to Statistical Control requires much effort and many studies, but its cost is negligible, compared to the savings it can produce. This, then, is the most important long-term project. For example, one new manufacturing process at Firth Sterling employs a relatively complex chemical operation, and the application of Statistical Quality Control is susceptible to many unknown variables. Many of these variables have not always been recognized as important in the process. An operation of this type presents the most difficult challenge possible to Quality Control, but at the same time it holds a promise of the greatest possible savings. Since the effect of most of the variables present are unknown, none can be overlooked.

This department is expected to measure every possible factor in at least fifty successive batches, through every operation from the raw ore to the finished tungsten. These measurements will include particle sizes, temperatures, acidity, moistures, humidity, residual impurities, gas volumes, pressures,, and any other factors that can be discovered.

If the values determined for any one factor are found to be the same in each of fifty successive batches, that factor is presumed to be in control without additional effort. If the values show variation beyond a reasonable amount, then corrective measures are developed in cooperation with the Production and Research Departments. These corrective measures may consist of modifications of existing mechanical equipment, additional instruction of personnel, or the institution of inspection methods. When these changes prove effective by controlling fifty successive batches, the operation is considered in control.

After procedures have been established under which a controlled operation may be carried out, it is the responsibility of operating personnel to maintain the standards of the operations, with only periodic reviews of that control by the Quality Control Department. It can readily be seen that once control is established, each batch will be processed in exactly the same manner. If the process begins with an acceptable raw material, the end result will be a uniform, controlled, reproducible product. That product can be tested, and controlled changes can be made for improvement with assurance that the difference in test performance is the result of the changes, rather than the results of unknown and uncontrolled variables.

The functions of the Quality Control Department, then, are these:

1. To gather information from any and all sources which pertain to the production of quality products;
2. To refer the best of this information for inclusion in the product standards;
3. To interpret the standards covering the company's methods, processes, materials and products;
4. To secure reasonable observance of those standards in the different operating departments.

This should never be construed as an effort to stifle progress. Standards are good only so long as they represent the best possible method or product, and they are constantly subject to review and modification. However, such modification must be carried out in a controlled manner. Uncontrolled or indiscriminate changing of methods or products can only result in unforeseen problems which are frequently more serious than the difficulties for the elimination of which they are proposed.

* * * * *

Abrasive Service Renewed

Ace Abrasive Laboratories, New York City, now offer a consultation service, similar to the one established in World War II, for solving special finishing problems during the present emergency. Their Research Division is working on new techniques that promise to produce an even finer mesh and grading in Ace Abrasive STAR-DUST diamond lapping compounds and powders.

SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

Eliminate MARKING DEP'T BOTTLENECK

Writes Like a Pencil on Anything!

Engrave with **BURGESS**

vibro-graver

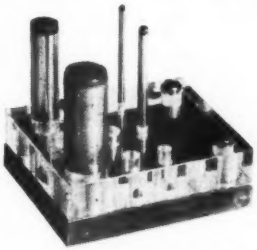
Now you can *permanently* mark steel, cast iron, glass, wood, lead and other hard surfaces as "O.K.," "Reject" . . . or with serial numbers, names for identification, departmental insignia, etc. Burgess electric Vibro-Graver with Tantalum Carbide point engraves as easily as writing with a pencil. (Diamond point also available.) Stops mix-ups! Avoids confusion! Helps prevent theft and inventory shrinkage! Ideal for Government contract work. Write, stating marking problem, for full information.

Only $8.95 Complete

BURGESS VIBROCRAFTERS, INC.

180 NORTH WABASH AVENUE • CHICAGO 1, ILL.

TRANSPARENT Shim Stock PUNCH



. . . for easy and precise location of center lines.

ADAPTABLE—punches any metal up to .025" in thickness. Also, rubber, paper and other materials.

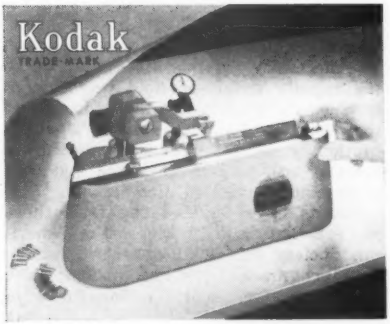
ACCURATE—clear vision and center lines allow precise punching.

PUNCHES HOLES—1/16", 3/32", 1/8", 5/32", 3/16", 7/32", 1/4", 5/16", 3/8", 7/16", 1/2", (Standard Punch) 5/8", 3/4".

Special sizes built to specifications.
"A Must for Every Plant".
Please write to:

Allied Tool & Die Company

305 No. Baum St. Saginaw, Mich.



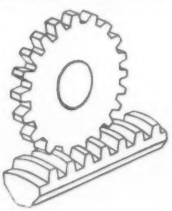
Test gears in *action*

Test production gears against the Kodak Conju-Gage Worm Section. For the composite check of gears, it's more accurate, less expensive, and more versatile than a circular master gear for the same test. It's much easier and far faster than older methods using measuring wires.

With a Kodak Conju-Gage and a single Worm Section you can make a composite test—checking runout, base pitch error, tooth thickness variation, profile error, and lateral runout . . . all in one operation.

The Kodak Conju-Gage costs no more than conventional types of variable center distance fixtures. It cuts costs by PASSING EVERY RIGHT GEAR . . . REJECTING EVERY WRONG GEAR.

For more information on this Kodak Conju-Gage (and other models handling gears up to 8¼-inch pitch diameter), write Eastman Kodak Company, *Industrial Optical Sales Division,* Rochester 4, N. Y.



Kodak

CONJU-GAGE

SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

tion, for "Industrial Quality Control" was the official journal of the Society. The necessity for qualified guidance of the rapidly unfolding field was evident to these forward-seeing individuals and they laid their plans thoughtfully and cautiously to this end, establishing a Society with both professional and non-professional types of membership.

Events have justified the faith those pioneers had in their ideas. The American Society for Quality Control is now the recognized fount of authoritative quality control matters, the finest in Quality Control literature and the hub around which modern Quality Control activity revolves. Comprising 43 Sections from Boston to San Francisco (plus two in Canada) the membership is now about 3,500. Growth has been more rapid than that of any other similar society and has been paralleled only by the increasingly rapid acceptance of this modern management tool by industry. Some 1,400 representatives from nearly every State in the United States and from almost every type of industry imaginable, recently attended the Fourth Annual Convention of the Society at Milwaukee. Associated with top levels of the organization will be found the names of representatives of some of the largest and best known corporations in the country.

The question no longer is "Will Quality Control help me?" but has become one of "How soon can I get it and what is the best way for me to do so?" One occasionally hears "How much will it cost?" but the thousands of authenticated case histories emanating from some of those organizations noted for their progressive management ideas have proved that this is a question of small concern.

Right at the outset it should be clearly understood that it is definitely not necessary to build up a large additional organization or department to take advantage of Quality Control. One individual, thoroughly grounded in the background, principles, and mathematics is essential, but usually one such individual in an organization is sufficient. The answer to "Where does Q. C. belong in the present organization?" has almost as many answers as there are types of organizations. For a simple operation (a small, closely-knit organization) it has usually been attached in some manner or other to the Inspection Department. Such a set-up definitely limits the potentialities of scope, however. In a multi-department operation of some size, it has proved advisable to have one individual in complete charge, with connections in each department, answering to the production chief. To get the ultimate in returns, this individual should report to the Executive Vice-President rather than the Factory Manager. The sound reasoning behind this will be made evident later. In a widespread multi-plant operation, it is absolutely essential that the top man answer to top management in a staff capacity, and that the individuals in charge in the various plants report to this staff man. Such responsibility on the part of the plant Q. C. supervisors might be dual, to the individual plant manager AND the staff man, but never the former to the exclusion of the latter. Such a set-up insures unified control over administrative features and is fundamental to the coordination of the many operational phases ultimately involved.

The Number One man (and his plant supervisors, if any) may be chosen from the Q. C. professional field as an outside man, or may be selected from your own organization. It is surprising how quickly a competently trained Q. C. man will familiarize himself with your problems, but because interpretation and corrective action is such a vital part of a successful program it is frequently advisable to select a man within the existing organization. Too critical attention cannot be paid to such selection. The individual should be chosen with the firm thought that he will eventually operate at policy making levels. If such a man is available and is selected, next comes the problem of training. Here, nothing but the best should suffice, and consultation with qualified people will produce competent advice. Don't skip this important link in the chain.

The mathematicians have studied and simplified the background mathematics, reduced certain things to easily used tables and simple formulas, and have collaborated with practical men so that

(Continued on page 125)

BIG MACHINE *Performance*

SMALL MACHINE COST!

SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

QUALITY
Measuring - Testing - Inspection
CONTROL

How Jig Borers and Grinders Can Inspect Their Own Work

As accurate as any other precision inspection system, the Moore jig borer and jig grinder provide faster, more simplified inspection procedures.

The enormous value of the jig borer and jig grinder as inspection machines is not as generally recognized as it should be. This perhaps is because of the common assumption that work should not be checked on the same machine that does the work. However, an analysis of various procedures used indicates that the speed, accuracy and ease with which these machines can be used to inspect their own work, will show that this assumption is unfounded.

On our Moore jig borers or grinders, the work is inspected before it is removed from the machine. The inspector can check the coordinate layout and run around all the holes with an indicator in far less time than they can be checked by any other means. The difference between the jig borer and jig grinder and any other good standards is usually not in excess of "half-tenths", much smaller than the additional errors introduced by transferring the work from one system to another.

In inspecting jig bored or jig ground work, each hole must be picked up, or observed, and related in some way with a standard of measurement. In general, one of three pick-up methods might be used:

(1.) **Indicating directly upon the surface of the hole.** The point of contact is uncertain, especially in small holes, unless the indicator is held in some manner to insure approaching the hole from a direction in line with its center, and unless the indicator can be rotated all the way around the hole.

(2.) **Indicating one side of a tight-fitting precision plug.** Indicating one side of a hole or pin presupposes exact knowledge of size. A plug is far easier to measure than a hole; in fact, the hole cannot be measured accurately without first making a plug. The pin may not fit exactly, may be tipped in the hole, or the hole itself may not be perpendicular to the surface of the workpiece. Extending this error through a plug gage to the outside of the workpiece only accentuates the error.

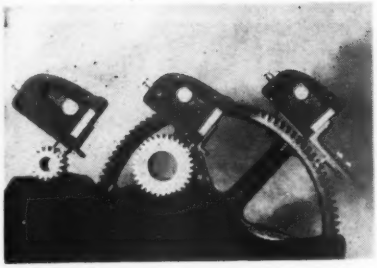
(3.) **Picking up the edges of the hole optically with a microscope containing a ruled reticle.** This eliminates spring tension devices, such as indicators, but has the disadvantage that only sharp corners can be observed accurately. The hole and surface of the workpiece must be lapped to produce a sharp edge.

Three methods are also normally used to relate the pick-up to a measurement standard:

1. Inserting a stack of gage blocks between two pins, protruding from holes. This measures directly between the holes, and is accurate if skillfully done. It measures position in one direction only, however, along the chordal dimension, and does not relate it angularly.

2. Standing the workpiece on its edge, or strapping it to an angle iron, referring all locations to a surface plate across the tops of fitted plugs, through the indicator and stacks of gage blocks. The location

by **Richard F. Moore**
President Moore Special Tool Company, Inc.
Bridgeport 7, Connecticut



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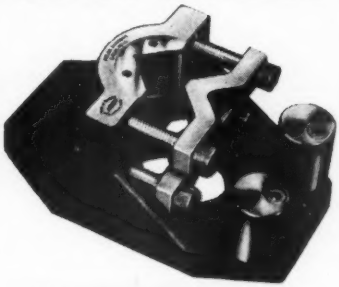

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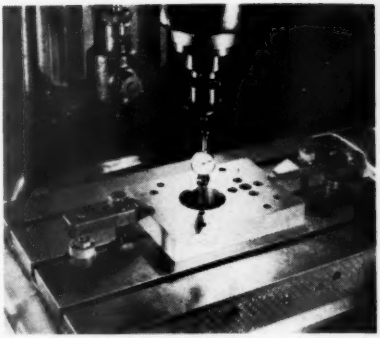
of each hole is determined by an individual measurement to the surface plate. The relation between any two holes is found by subtracting one of these measurements from another. In addition to the possibilities of errors mentioned previously, this method checks the holes in one direction only, and requires rotation through 90° to check the perpendicular dimension.

3. Strapping the workpiece to a coordinate location device, such as the toolmaker's microscope or the jig borer or jig grinder. The holes are picked up with the indicator or microscope, and related to the coordinate location system, checking in two directions at once.

In both 2 and 3, hole locations are referred to a common base, not directly from one to another.

Often a hole, or row of holes, is assumed as the "starting point", usually those on the center line from which all dimensions are built up. Actually, the theoretical base line must be established from the average errors of all the other holes, and cannot be established until all holes are checked. It is usually necessary to re-orient the workpiece with respect to the theoretical base line to find the final error of each hole.

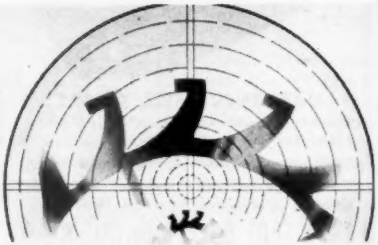
A simple example of this need for reorientation is shown by the inspection charts, Figures 1 to 3. In each case, the holes on the horizontal center line were used as a base to check vertical distances, and the holes on the vertical line as a base for horizontal distances. The deviations between First and Second Inspections, Figures 1 and 2, respectively, were probably errors in picking up the base holes. The two inspection charts re-



Above: Typical example showing a dial indicator being used on Jig Borer to check a hole in a die block. This is one of three "pick-up" methods described in text.

Below: The toolmakers' microscope is an invaluable aid for inspecting holes having finely-finished, sharp edges. This method eliminates spring tension devices such as indicators.

CONVENTIONAL MICROSCOPE inverts image, reverses table movements; confuses operator.



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oriented show what would result if the workpiece had been set up .0001" lower and .0001" farther to the left the first time; and .0001" higher and .0001" to the left the second time.

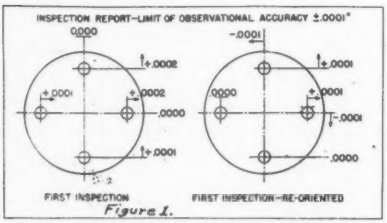


Figure 1.

Averaging the re-oriented sketches produces the dimensional errors shown in Figure 3, which, if further re-oriented, would give the probable actual locations of the holes. This cannot be stated certainly, however, since the inspection equipment is assumed to have an observational limit of accuracy of plus or minus .0001".

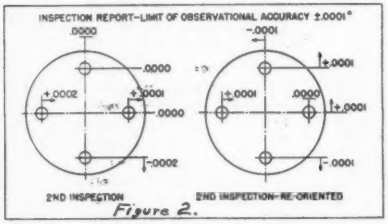


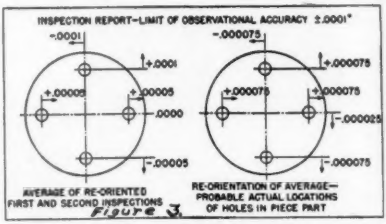
Figure 2.

These examples show only probable mis-orientation in parallel directions. Directions of the errors in Figure 4 show that the workpiece should be moved to the left, and at the same time, rotated clockwise. The nature of the errors indicates that reference holes A and B were misaligned in different directions when the pick up was made. The workpiece should be rotated around point X, so that hole A is moved downward and hole B is moved upward. The resultant chart of errors would then appear as in the sketch "Re-orientation Laterally and Angularly."

It should not be assumed that re-orientation alone is sufficient. Each measurement should be taken enough times for a reasonable average to be derived.

Most of this time-consuming re-orientation is eliminated when work is checked in the jig borer or jig grinder. The work will not check out as it was bored, due to errors naturally present in the operation of the machines.

The jig borer and jig grinder are subject to temperature changes, strains from cutting tools and vibrations, all resulting in minute changes from true position. Out-of-roundness of a hole, although minute, can also be found if the indicator is always held in the spindle so as to face the opposite direction as the cutting or grinding.


INSPECTION REPORT—LIMIT OF OBSERVATIONAL ACCURACY ±.0001"
AVERAGE OF RE-ORIENTED FIRST AND SECOND INSPECTIONS
RE-ORIENTATION OF AVERAGE—PROBABLE ACTUAL LOCATIONS OF HOLES IN PIECE PART
Figure 3.

When the machines are used for inspection, they are free from vibration and stresses, and, since the inspection is done in a short period of time, serious temperature changes cannot take place. For these reasons, some errors will be found. These are very small, and usually in the same direction. A small amount of parallel re-orientation will cancel them out.

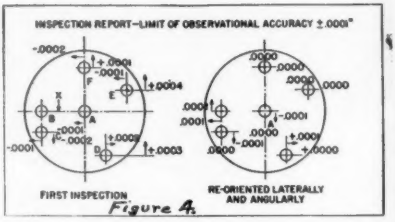


Figure 4.

When the rotary table is used, additional errors, both in fabrication and checking, are introduced. Errors in picking up the center of the workpiece with respect to both the rotary table and machine spindle, errors in the dividing system and errors in reading the dividing

(Continued on page 134)

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Hunter Teaches Quality Control and Spring Design

The two courses, (I) Spring Design & Specifications and (II) Quality Control, now in progress at the Hunter Spring Company, Lansdale, Pa., mark the third successive year in which industrial personnel have convened at the Hunter plant to attend both the two-day sessions of lecture and demonstration.

In Hunter's words, the purpose of the Quality Control course is "to stimulate awareness and appreciation of the benefits of modern quality control procedures by study of technique already in use". The Spring Design & Specifications course is conducted "to promote better spring design and use by a clear-cut analysis of the engineering and manufacturing principles involved". In each course the purpose is achieved by blending principles and practice at the blackboard and on the plant floor.

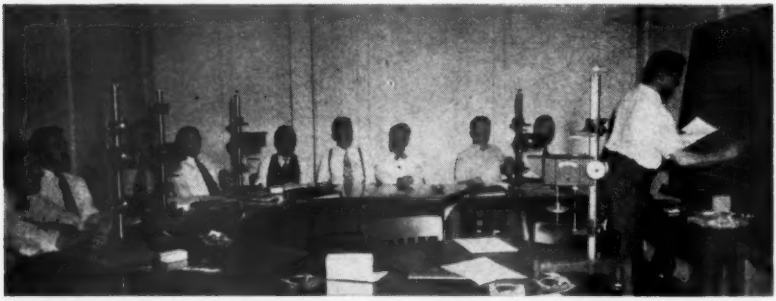
Among the companies represented at both courses are Hunter customers, vendors and friends seeking a more thorough understanding of the function of quality control in the manufacture of springs, modern inspection technique and efficient design and specification methods. Although specifically concerned with spring manufacture, each course—because of the advanced technology practiced at Hunter—presents a sound insight into good industrial practice.

The men attending the Quality Control courses include production men, purchasing agents, quality control analysts and inspectors. The Spring Design & Specifications course is attended by a more specialized group—designers and engineers in the many industries using spring components.

Realizing that the value of any course, industrial or academic, is proportional to the experience and ability of the instruction, Hunter has chosen its top men in spring design, production, inspection and cost control to lead those courses in which they have a thorough knowledge in theory and in practice.

The Quality Control and Spring Design & Specifications courses are scheduled on two days of alternate weeks. On the first day, after a short introduction to the program, the men enrolled in each course are conducted on a tour of the Hunter plant. In both courses, the automatic coiling, grinding, heat-treating, spring finishing, tool, electroplating, inspection and testing departments are visited and observed during operation by the class. The participants are then in a position to understand the function of specific operations in the overall manufacturing picture.

(Continued on page 122)



These participants in the Hunter Quality Control Course set up Baldwin-Hunter Spring tester, test entire sample and record results in frequency distribution form. F. C. Schulze, Chief Inspector, is leading this session at the blackboard.

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of gages, and statistical sampling plans.

Furthermore, in the early stages of experience with certification, it tests the capability of the buyer to properly audit the vendor's ability to certify. As we develop this program further, we believe it will be possible to modify this correlation period to some extent.

If the results of the correlation period are satisfactory, then the vendor and the buyer are ready for a formal certification agreement.

In this written agreement, which is an adjunct to the purchase contract, we formalize the procedure previously established with modifications that have been found necessary during the correlation period. One important addition is made, however. The buyer agrees to accept and scrap or rework at his own expense any defective parts in a shipment, provided that none of the AQL's for major or minor categories is exceeded with respect to that shipment.

If the buyer's audit indicates that the AQL has been exceeded, the entire shipment is rejected at the vendor's expense. This agreement does not affect any warranty contained or implied in the purchase order.

Lastly, we set forth a procedure for termination of the agreement upon suitable notice if and when either the vendor or the buyer feels that it is desirable.

One of the basic requirements of any successful quality level certification program is a willingness on the part of both the buyer and the vendor to sit down and discuss freely any problems that may arise, and make necessary adjustments where details are in dispute.

Certification provides for the safeguarding of quality against accidental or natural human error; but like any business transaction it depends to a certain extent on the mutual faith the buyer and the vendor have in each other.

Such, then, is the basic structure of quality level certification, as it has developed thus far in our operations. We have high hopes for it as far as the future quality of our products is concerned. We believe it will have a definite effect on our overall costs, and that it will be a great help in cementing our relationships with our vendors.

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PUBLICATION

Keep Informed! CATALOGS • BULLETINS • SPECIFICATIONS

NEW LAPMASTER BOOKLET. An attractive, 16-page publication has been issued by Crane Packing Co. on their line of Lapmaster lapping machines. Typical subjects treated in this highly illustrated booklet are: How the Lapmaster Works; Why the Lapmaster Method is More Efficient; Three Typical Installations; Basic Design Features; Special Attachments and Setups; and Lapmaster Accessories. Write to CRANE PACKING CO., Dept. H-13, 1800 Cuyler Ave., Chicago 13, Ill.
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THE VISUAL THREAD COMPARATOR of Hanson-Whitney has been designed for the inspection and production gaging of external threads. It tells at a glance whether the product is oversize, undersize, eccentric, tapered or if lead error exists. The work is recorded visually to accepted ring gage tolerance. Write to HANSON-WHITNEY CO., 170 Bartholomew Ave., Hartford, Conn., for a copy of the illustrated Visual Thread Comparator Catalog.
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PRECISION MARKING DEVICES are covered in Parker's Catalog No. 47. Described and pictured are marking dies; graduating, embossing and coining dies; and mechanical engraving.
Inform-A-Gram No. B45.

MILWAUKEE SURFACE PLATES are featured in the current catalog of J. C. Busch Co. These plates are finish-planed and scraped to insure a highly accurate surface.
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PREVIEWS

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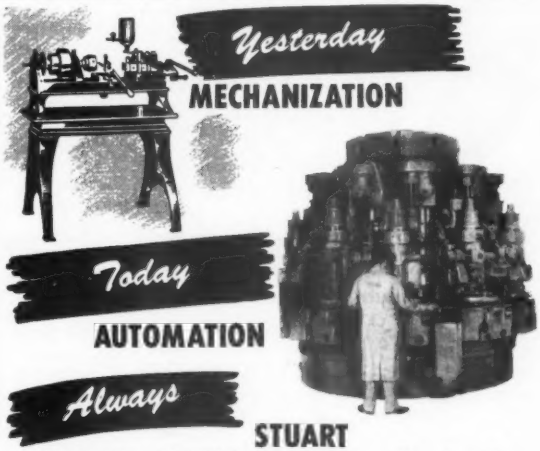

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PUBLICATION PREVIEWS

A FEATURED GRINDER in Bulletin 30, issued by The Cincinnati Electrical Tool Co., has two 10" x 1" grinding wheels, full 1 hp motor, exhaust outlets on wheel guards, all-angle tool rests, fabricated steel pedestal, 20" between wheels and ball bearing construction.
Circle Inform-A-Gram No. B52.

MICROMETER CATALOG. Tubular Micrometer Co.'s extensive, 80-page Catalog No. 20 demonstrates what is new in micrometers. This pocket-sized publication is well illustrated.
Circle Inform-A-Gram No. B53.

"MICRO-MESH" DIAMOND LAPPING COMPOUNDS are described in interesting literature available from A-1 Abrasive Laboratories, Inc.
Circle Inform-A-Gram No. B54.

THE SPEEDEX AUTOMATIC DIAL INDEX FEED, available from de Castro & Associates in 12", 15" and 24" diameter, is adaptable to any press for the purpose of increasing production rates. Literature is obtainable.
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PRECISE GRINDER-MILLER. A new catalog prepared by Precise Products Co. covers both the new Super 50 Grinder-Miller and the earlier Super 40 models. These useful attachments are accurate to .0001".
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"THE TOOL STEELS OF ALLEGHENY LUDLUM" is a valuable, 176-page handbook. Recommendations, applications and a tool steel "finder" are included.
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OUTSIDE
HAND RADIUS
TUBING GROUP
STANDARD Chamfering
SOLID (For Radius Lip)
COUNTERSINK GROUP
STANDARD
HEAVY DUTY
BALL SEAT REAMER

GEARMASTER INSTRUMENTS are described in current literature from Urbauer Engineering Co., designers of the Gearmaster System of measuring gears. With these instruments, several measurements of gear characteristics can be made in one operation and to a high degree of precision. Write for this illustrated literature to URBAUER ENGINEERING CO., Dept. TDJ, Naperville, Ill.
Inform-A-Gram No. B58.

INDEX MODEL 60 PLAIN MILLING MACHINE is a versatile and accurate horizontal mill with full No. 1 capacity. Bulletin No. 60 lists complete specifications and describes additional accessories that are available.
Inform-A-Gram No. B59.

THE SWEEP TYPE PUNCH PRESS SAFETY GUARD sweeps across the feed area on the downward stroke of the ram. Complete information is given in Searjeant Metal Products' Bulletin 125.
Inform-A-Gram No. B60.

"JOHN'S" DRILL JIGS, which provide a common base and a quick clamping action, are explained and illustrated in a set of folders published by Heuser Mfg. Co.
Inform-A-Gram No. B61.

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

THE HELIOS VERNIER CALIPER NO. 55A is being marketed by Karl A. Neise. This precision instrument is for inside, outside and depth measurements to .001" or 0.1 mm. It has 6" (English) and 150 mm. (Metric) scales on the one tool. Descriptive literature is available. Address KARL A. NEISE, 381 Fourth Ave., New York 16, N. Y.

Circle Inform-A-Gram No. B62.

THE D. S. P. HOPPER UNIT, a selective feeding device whereby production parts are selected, oriented and fed in a given position for primary and secondary operations, is among the time-saving devices presented in the 1950 Detroit Power Screwdriver catalog.

Circle Inform-A-Gram No. B63.

PRECISION GRANITE SURFACE PLATES, with surfaces finished to an accuracy of .0005" in standard stock sizes, are the subject of a brochure from The Herman Stone Co. Sawed from huge blocks of granite, which has no internal strain, these plates are non-warping. Write for brochure to THE HERMAN STONE CO., 324 Harries Bldg., Dayton 2, Ohio.

Inform-A-Gram No. B64.

CARBIDE-TIPPED TOOL CATALOG NO. 104 is a current Whitman & Barnes publication. It lists and pictures taper shank drills, core drills, lathe centers, chucking reamers, etc. Information is also included on the use and care of these tools.

Inform-A-Gram No. B65.

GRAYMILLS STOCK-LUBE SYSTEMS are described in a new catalog containing construction and engineering details. These systems provide a modern and efficient way of lubricating roll, strip and individual metal sheets.

Inform-A-Gram No. B66.

THE HARDINGE HIGH SPEED CHUCKING MACHINE is featured in current Bulletin HC. Design highlights and specifications are given.

Inform-A-Gram No. B67.

DUMORE AUTOMATIC DRILL HEADS increase production, cut drill breakage and cut scrap loss. How these economies are effected is described in the new 16-page bulletin offered by The Dumore Co.

Circle Inform-A-Gram No. B68.

THE STUDLER ANGLE COMPUTER speeds up layout, inspection and machining of angles and compounds angles. Illustrated bulletins on various models are now being distributed.

Circle Inform-A-Gram No. B69.

THE PUTNAM END MILL CATALOG includes over 800 standard sizes and types. There is a Putnam end mill for every application.

Circle Inform-A-Gram No. B70.

Whatever the Shape!
STARCO MASTER GRINDING ATTACHMENT
is essential for
RAPID, PRECISION GRINDING AT ½ SAVINGS IN TIME!
A versatile, precision unit designed to make it possible to grind any combination of rounds, flats, grooves, indexed sections, radii, splines, etc., in a single setting, using only a surface grinder. Essential for rapid, precision manufacture of gauges, punches, jigs and fixture parts, die parts, studs, etc.
The Master Grinding Attachment pays for itself by eliminating the necessity of setting up four or five machines for the production of a few parts.
Write for descriptive Catalog showing universal uses.
Star GAUGE COMPANY
261 Oak Grove Ave.
SPRINGFIELD, MASSACHUSETTS

SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

PUBLICATION PREVIEWS

STEEL CITY PROVING RINGS of the direct-reading type are used in calibrating the loads of various types of testing machines and presses, including Brinell and Universal testing machines. A file-size data sheet just published gives full information on sizes, capacities, weights and dimensions of these instruments. A copy may be secured from STEEL CITY TESTING MACHINES, INC., 8843 Livernois Ave., Detroit 4, Mich.
Circle Inform-A-Gram No. B71.

DIAMOND LAPPING COMPOUNDS AND POWDERS. Finishes of less than one half a micro inch on dies, tools, molds and parts may be obtained with Stardust laboratory-graded compounds and powders. Detailed literature has been issued by Ace Abrasive Laboratories.
Circle Inform-A-Gram No. B72.

ROLL FEED BULLETIN. Roll-Feeds Corp. has issued a new bulletin on "RFC" Precision Roll Feeds for all types of presses. It consists of four colorful pages of illustrations, prices and descriptions. Design and operation features are pointed out. Get your copy by addressing ROLL-FEEDS CORP., Dept. TDJ, Pawtucket, R. I.
Circle Inform-A-Gram No. B73.

EX-CELL-O SPINDLES, which will step up production, are presented in the comprehensive Ex-Cell-O Precision Spindle Catalog. Copies are now being mailed.
Circle Inform-A-Gram No. B74.

"MICRO MINIATURES," small end mills that do a big job, are described in a current Woodson Tool Co. catalog. These end mills are precision ground from the solid.
Circle Inform-A-Gram No. B75.

Best in the Country!
BECAUSE THEY'RE
• WHIPSLEEVE SUPPORTED
• STRAIGHT-GROUND
• HIGH SPEED STEEL
pivot
U.S. and Foreign Pat.
punches
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"Pioneers in High Speed Steel Punches"
PIVOT PUNCH AND DIE Corporation
373 OLD NIAGARA FALLS BLVD NORTH TONAWANDA, N.Y.

A NEW MICROSCOPE ILLUMINATOR, the Bausch & Lomb Micro-Lite, is described in current Folder D-1020. This low-priced light source is compact (only 8⅛" x 3⅛"), lightweight (just over 2 lbs. including cord) and uses an ordinary 40-watt lamp. The condensing lens is of the bull'seye type with one surface ground to provide evenly diffused illumination. Write to BAUSCH & LOMB OPTICAL CO., Dept. TDJ, Rochester 2, N. Y.
Inform-A-Gram No. B76.

KIPP AIR GRINDERS provide the subject matter for Madison-Kipp Corp.'s colorfully illustrated Air Tool Catalog AT3006. The speed of these grinders drops only slightly when put to work, meaning better work and longer wheel life.
Inform-A-Gram No. B77.

A PORTABLE HIGH FREQUENCY INDUCTION HEATING UNIT is the subject of literature just off the press. This Lepel unit will braze carbide tips to cutting tools up to 1½" square and will melt 4 oz. of steel or brass in four minutes.
Inform-A-Gram No. B78.

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

THE BUHL S-129 POCKET MICROSCOPE is a versatile, precision-made instrument for shop, laboratory and field inspection. Covering the useful 40 to 60-power range of magnification, it is capable of minute, undistorted physical inspection—yet its compact design permits use in awkward, hard-to-reach places. Descriptive literature may be secured from BUHL OPTICAL CO., Dept. TT-1, 1009 Beech Ave., Pittsburgh 12, Pa.
Circle Inform-A-Gram No. B79.

DYMO DIAMOND COMPOUND—fast cutting, economical, easy to use and universally soluble in commercial solvents and water—is the subject of an interesting bulletin prepared by Industrial Products Div., Elgin National Watch Co.
Circle Inform-A-Gram No. B80.

OVERHEAD ELECTRIC TRAVELING CRANES are shown in a wide range of installations in metal fabricating plants, tool and die shops, foundries, etc., in a fully illustrated new booklet, No. G-700, issued by Northern Engineering Works. Get your copy by addressing NORTHERN ENGINEERING WORKS, 2615 Atwater St., Detroit 7, Mich.
Inform-A-Gram No. B81.

THE ROBBINS MAGNA-SINE, for fast and accurate angular grinding setups, is featured in a current catalog. The Maga-Sine acts as a versatile magnetic chuck for all surface grinders and is built in two styles.
Inform-A-Gram No. B82.

KEMPSMITH'S LH MILLER is a light, horizontal milling machine, excellent for "in between" jobs. The company's descriptive Bulletin No. 127, covering this machine, is being circulated.
Inform-A-Gram No. B83.

PERKINS NO. 201-S BACK-GEARED PRESS is a long-stroke (7") press with ample die space for unusual requirements. A new bulletin will give you full particulars.
Inform-A-Gram No. B84.

BOKUM BORING TOOLS, available in three styles and in a wide range of sizes, are covered in a series of current catalogs. These catalogs describe steel, carbide-tipped and solid carbide boring tools.
Circle Inform-A-Gram No. B85.

FACTORY-ASSEMBLED AND INSPECTED DIE SETS are presented in an attractive, 48-page catalog issued by Detroit Die Set Corporation. Dimensions, prices and pictures are included in the publication.
Circle Inform-A-Gram No. B86.

SENSITIVE DRILLING MACHINES, capable of drilling holes .002" diameter, are described in Bulletin 752 from Taylor Dynamometer & Machine Co.
Circle Inform-A-Gram No. B87.

New Possibilities IN GRINDING TUNGSTEN CARBIDE

VISUAL GRIND

Combines 3 *Different Techniques..*

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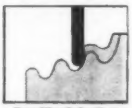

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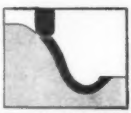

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New, but proven, Visual-Grind combines the image, profile and templet techniques in one machine, greatly broadening the scope of contour grinding. Carbide tungsten work-pieces, heretofore most difficult, are easily handled. The image technique readily grinds work-pieces whose shank diameters are larger than the contour ends. The templet method handles jobs too large to magnify on the screen. New possibilities... enormous savings... extreme accuracy!

Ask for Bulletin T-10.

VISUAL GRIND THE CLEVELAND GRINDING MACHINE CO.

6512 ST. CLAIR AVENUE · CLEVELAND 3, OHIO

SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

PUBLICATION PREVIEWS

DYKEM STEEL BLUE is designed to stop losses in the making of dies and templates. The dark blue background makes the layout lines show up in sharp relief, and at the same time prevents glare. Detailed literature is offered.
Circle Inform-A-Gram No. B88.

THE FEEDMASTER AUTOMATIC AIR FEED handles material from foil to two-by-fours. A descriptive brochure is offered by Great Western Tools, Inc.
Circle Inform-A-Gram No. B89.

BENCO MASTER COLLETS AND PADS will enable the user to obtain solid collet service at the price of collet pads. Send for a copy of the new Benco Collet Catalog.
Circle Inform-A-Gram No. B90.

CHALLENGE LAYOUT SURFACE PLATES come in sizes from 12" x 18" to 54" x 144". All are made of semi-steel, and standard plate thickness is 6". Full information is now being mailed.
Circle Inform-A-Gram No. B91.

THE AO OPTICAL PROJECTION COMPARATOR makes speed and economy possible in checking critical components right at the production line. American Optical Co. will provide illustrated literature.
Circle Inform-A-Gram No. B92.

THE COMPLETE LINE OF SURFACE GRINDERS made by Reid Brothers Co., Inc., is illustrated and described in the company's attractive 50th Anniversary Catalog.
Circle Inform-A-Gram No. B93.

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Balancing!

HI-EFF

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FONDA'S LIFETIME-CARBIDE GAGE BLOCKS offer toughness, wear resistance, accuracy and good wringability. An illustrated catalog details these features and lists latest prices. Your copy may be obtained from FONDA GAGE CO., INC., 59 Daly St., Stamford, Conn.
Inform-A-Gram No. B94.

T-NUTS AND STUD SETS, step block sets, punch press sets, jig feet, screws, hand knobs and many other tool specialties are described in the extensive catalog published by Northwestern Tool & Engineering Co.
Inform-A-Gram No. B95.

THE ACE UNIVERSAL TOOL AND CUTTER GRINDER is the subject of a new technical bulletin prepared by Oliver Instrument Co. Features that enable this grinder to perform fast and accurately are pointed out.
Inform-A-Gram No. B96.

THE DUAL ELECTRO-MAGNETIC DEVICE, demagnetizes tools, small gears, etc., on 100 ac. It will magnetize small tools on 24-100 dc. Magnetic Specialties Corp. offers full information.
Inform-A-Gram No. B97.

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

A JIG AND FIXTURE DATA BOOK, containing more than 80 pages of dimensional data on the Q-C (Quick-Clamp) method of standardization of production fixtures, may be had from Q-C Engineering Products, Div. of Pearson, Inc.
Circle Inform-A-Gram No. B98.

THE NEW 14" ECONOMY MODEL DRILL PRESS is presented in South Bend Lathe Bulletin 402. Specifications and features are listed in this illustrated publication.
Circle Inform-A-Gram No. B99.

PRECISION LATHES and accessories, ideal for instrument work and second operations, are presented in Bulletin F, issued by Louis Levin & Son, Inc.
Circle Inform-A-Gram No. B100.

SKILLFUL GRINDING OF A HARDNESS TESTER is a featured subject in the current issue of Norton Co.'s "Grits and Grinds" technical house organ. This issue also details the advantages of the Norton Ceramic Surface Plate. To get on the mailing list for "Grits and Grinds," write to NORTON CO., 1 New Bond St., Worcester 6, Mass.
Inform-A-Gram No. B101.

TRACER-CONTROLLED MACHINE TOOLS and accessories made by George Gorton Machine Co. are presented in Bulletin 1655-1210. Descriptions of duplicators, pantographs, cutter grinder, automatic lathes and milling machines are included.
Inform-A-Gram No. B102.

THE BECKETT AIR POWER DRILL PRESS FEED and tapping control can be used with a multiple drilling head to tap extruded holes in steel. Bulletin No. 20 will give you all the facts.
Inform-A-Gram No. B103.

COMMANDER PRODUCTION TOOLS, including the adjustable MULTI-DRILL, the Commander Tapper and the new Drill Chip Breaker, are covered in illustrated circulars now being distributed.
Inform-A-Gram No. B104.

HANDNIBS, made by National Machine Tool Co., shear and nibble (outside and inside) up to 3/16" flat stock; openings for cutting 3/16", ¼", 5/16" and 3/8" rods. Detailed literature may be had upon request.
Circle Inform-A-Gram No. B105.

SHORT-RUN PRODUCTION PARTS can be produced accurately, at low cost, by Lamina Dies & Tools, Inc. A colorful bulletin illustrates Lamina's facilities and fully describes their range of products and services.
Circle Inform-A-Gram No. B106.

WET AND DRY CARBIDE TOOL GRINDERS are described and pictured in Hammond's Catalog No. 220. This attractive booklet lists features and specifications.
Circle Inform-A-Gram No. B107.

Looking for ways to cut costs?

use a WELLS
METAL CUTTING BAND SAW

In thousands of plants all over the world, Wells Saws are proving that it is possible to cut metal faster and more accurately at lower cost. This is accomplished through machine design and the principle of *continuous cutting.* As each tooth does its share of the work, the blade is cutting all the time — there is no lost motion. This means more cuts per day and lower unit cost to you. Three standard models of Wells Metal Cutting Saws are available to meet virtually every need. Use the handy chart below to find the saw you need to meet your requirements and ask your Wells dealer for complete information or write direct.

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Products by Wells are Practical

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION

THREE RIVERS, MICHIGAN

SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

PUBLICATION PREVIEWS

UNBRAKO SOCKET HEAD CAP SCREWS, self-locking socket set screws, knurled head socket cap screws, fully-formed pressure plugs and many other money-saving products are covered in Standard Pressed Steel Co. literature.
Circle Inform-A-Gram No. B108.

WELLS METAL-CUTTING BAND SAWS provide fast, continuous cutting action and greater accuracy on each job. Illustrated literature is available to TOOL & DIE JOURNAL readers.
Circle Inform-A-Gram No. B109.

MERZ "NEW-TRONIC" GAGES are presented in a six-page, two-color catalog. Pictured and described are instruments and devices for precise measurement, including the Model C Comparator Stand and the Model H Height Gage Stand. For a copy address your request to MERZ ENGINEERING, INC., 200 S. Harding St., Indianapolis 7, Ind.
Circle Inform-A-Gram No. B110.

CONSULTING AND DESIGNING ENGINEERS. Ward Engineering Co. of Cleveland offers expert services on metalworking presses and special machinery. Complete information is available.
Circle Inform-A-Gram No. B111.

CAM MILLING AND JIG BORING SERVICES are offered by Eisler Engineering Co., Inc., of Newark, N. J. They also do spot welding, contract production and experimental development. Complete details are procurable.
Circle Inform-A-Gram No. B112.

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ROTARY FILES and TOOLS
THE COMPLETE LINE FOR EVERY INDUSTRIAL PURPOSE
over 5000 shapes, sizes and cuts
GROBET Hand Cut, and Ground from Solid ROTARY FILES
⅛" SHANKS
¼" SHANKS
⅛" SHANKS
⅛" SHANKS
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SOLD THROUGH LEADING SUPPLY HOUSES
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GROBET High Speed Rasps
GROBET FIN FILES
GROBET FILE COMPANY of AMERICA, INC.
421 CANAL STREET
NEW YORK 13, N. Y.
IN CANADA: 1418 Notre Dame W., Montreal P. Q.

A CATALOG ON HYDRAULIC CYLINDERS has just been completed by Hanna Engineering Works. This catalog, No. 233-A, has 28 pages of illustrations, specifications, design, construction and operation features, and suggestions for uses of Hanna hydraulic cylinders for working pressures up to 1500 lbs. Send your request to HANNA ENGINEERING WORKS 1765 Elston Ave., Chicago 22, Ill.
Inform-A-Gram No. B113.

QUICK PROCESS STAMPINGS produced by Quality Hardware and Machine Div. allow manufacturers to make many alterations before tooling up for long runs. Complete details are contained in available literature.
Inform-A-Gram No. B114.

DICKERMAN'S 9-INCH ROL-DI-FEED is a compact, self-contained, cam-driven feed that can be easily installed on a punch press. New literature gives prices and other data.
Inform-A-Gram No. B115.

A NEW DIVIDING HEAD, recently added to the line of Marvin Machine Products, Inc., is described in current literature.
Inform-A-Gram No. B116.

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

MORTON FIXTURE CLAMPS and standard fixture details of all types are illustrated in the 55-page, loose-leaf Catalog 4. Valuable full-size template drawings that can be used for tracing are included.
Circle Inform-A-Gram No. B117.

BAUMBACH PRECISION-BUILT DIE SETS are featured in the current 112-page Catalog No. 50. Features designed for the user's convenience include a five-page style chart and a thumb-index for use with the chart.
Circle Inform-A-Gram No. B118.

THE COMPLETE YOST LINE OF VISES is presented in a bulletin now being distributed by Yost Mfg. Co. A highlight of this publication is the introduction of the new Yost Drill Press Vise, available in two sizes.
Circle Inform-A-Gram No. B119.

A 10-POWER HASTINGS TRIPLET MAGNIFIER has been added to the line of Buhl Optical Co., according to new literature. Designated as Model S-171, this instrument is especially produced for shop use. The optical system consists of three elements cemented together, resulting in a composite lens that is dirt-free and light in weight. Chromatic and spherical aberrations are fully corrected, thus assuring a sharp, flat image to the very edge of the wide ¾-inch field of view. This means the elimination of color fringes that tend to reduce the useful field. The magnifier may be used with equal effectiveness from either side. Address BUHL OPTICAL CO., Dept. TT-1, 1009 Beech Ave., Pittsburgh, 12, Pa.
Inform-A-Gram No. B120.

DANLY DIE SETS, featuring stronger, safer, all-steel welded shank construction, provide the subject matter for a new bulletin offered by the Chicago firm.
Inform-A-Gram No. B121.

TOTE PANS of a new nesting type have been developed by J. L. Lucas & Son, Inc. Informative literature on these pans is obtainable.
Inform-A-Gram No. B122.

A HELPFUL BULLETIN ON PRECISION DRILLING may be had from The Electro-Mechano Co. Their drill press features finger-tip variable speed and a sensitive precision spindle.
Circle Inform-A-Gram No. B123.

RIVETT'S 1024 HYDRAULIC GRINDER reduces setup time with the universal wheelhead. It mounts both internal and external spindles and swivels 180°. Bulletin No. 1024A tells the complete story.
Circle Inform-A-Gram No. B124.

WARPLIS PRECISION GROUND FLAT STOCK is the subject of a folder issued by Pittsburgh Tool Steel Wire Co. Hardening recommendations, prices and general data are given in this four-page publication.
Circle Inform-A-Gram No. B125.

Trimming Formed Parts
AND HUNDREDS OF OTHER
CUTTING JOBS are FRICTION SAWN
QUICKER and BETTER
with **Tannewitz**
HIGH SPEED BAND SAWS!

Get your FREE COPY OF "FRICTION SAWING"

Friction sawing with Tannewitz High Speed Band Saws is much faster, easier and better than any other method of cutting formed parts, flat sheets of either soft or hard steel, non-ferrous metals, glass, plastics and many other materials. Down-drag of saw is so little that no rest of any kind is needed in trimming formed parts or castings. Savings in time and costs are immense.

THE TANNEWITZ WORKS, GRAND RAPIDS, MICH.

SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

PUBLICATION PREVIEWS

ATLAS METALWORKING MACHINE TOOLS are presented in an extensive catalog, No. M50. Sections of this 36-page booklet are devoted to lathes, shapers, milling machines and drill presses.
Circle Inform-A-Gram No. B126.

PIVOT PUNCH CATALOG NO. 222. This publication illustrates and describes a complete range of styles and sizes of Pivot Punches, formerly produced only to specifications.
Circle Inform-A-Gram No. B127.

THE DS RADIAL RELIEF GRINDER has eliminated complicated setup and computation. Royal Oak Tool & Machine Co. offers their interesting DS Catalog.
Circle Inform-A-Gram No. B128.

ATLANTIC SAWS meet all the requirements for a superior blade on complicated die and fixture radius cutting. A new catalog points out their many features.
Circle Inform-A-Gram No. B129.

INDICATOR AND MIKROKATOR GAGES, for all internal and external checking, are described in interesting literature from C. E. Johansson Gage Co., Div. of Swedish Gage Co. of America.
Circle Inform-A-Gram No. B130.

DRILL BUSHING CATALOG. Drill sizes, dimensions and other technical information, list prices, drawings and photographs make up the American Drill Bushing Co.'s catalog.
Circle Inform-A-Gram No. B131.

THE STANDARD D-4 ABRASIVE BAND GRINDER is one of the low-cost, high-quality finishing units described and illustrated in a new manual by Walls Sales Corp.
Circle Inform-A-Gram No. B132.

BE SURE OF SCRATCH-FREE FINISHING!

ELGIN DYMO
DIAMOND COMPOUND

Pure, *precision graded* diamond particles . . . assure fast, dependable mold polishing—free of possible scratches due to oversize abrasive particles! DYMO comes ready to use—brilliantly color identified in all Bureau of Standards grades—and will not cake or settle. For finer, faster finishing, at lower cost, try Elgin DYMO today! Guaranteed to be in accordance with Bureau of Standards specifications.

Write today for ***Free Demonstration****—right in your own plant!*

INDUSTRIAL PRODUCTS DIVISION
ELGIN NATIONAL WATCH COMPANY
ELGIN, ILLINOIS

WESSON VISES for hundreds of precision uses in every shop, are described and pictured in a brochure prepared by Wesson Products Co. These universal vises simplify difficult compound angle milling, drilling, reaming, shaping, die sinking, grinding, filing, slotting, sawing, tool sharpening, and other angle machining. Prices of all models are given. Address WESSON PRODUCTS CO., 1220 Woodward Heights Blvd., Ferndale 20, Mich., for this brochure.
Inform-A-Gram No. B133.

THE BURGESS VIBRO-GRAVER writes like a pencil on hardest steel. This new, speedy, permanent marking tool engraves numbers or names on tools, jigs, dies, gears, finished parts. It works by vibration on 110-v ac only. Burgess Battery Co. has compiled descriptive literature.
Inform-A-Gram No. B134.

THE BOECKELER SHOP MEASURING MICROSCOPE offers very high accuracy with 6½" range and excellent capacity for measurement of large and heavy work. An illustrated bulletin is obtainable.
Inform-A-Gram No. B135.

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

MOTOR MICA COOLING ANTI-FRICTION COMPOUND. A free sample and descriptive literature on this compound, which cools hot bearings quickly and saves wear on moving parts, may be had from Scientific Lubricants Company.
Circle Inform-A-Gram No. B136.

"FRICTION SAWING" is an informative booklet issued by The Tannewitz Works. It enumerates the time-saving advantages of friction sawing with Tannewitz High Speed Band Saws. All requests are being honored.
Circle Inform-A-Gram No. B137.

U. S. AUTOMATIC PRESSROOM EQUIPMENT can convert your presses to fully automatic operation. Bulletin No. 70-T contains complete specifications for these stock reels, slide feeds, stock straighteners, etc.
Circle Inform-A-Gram No. B138.

A SPECIAL TWO-WAY, SIX STATION HORIZONTAL MACHINE made by Krueger-Barnes has been producing very accurately machined parts averaging 200 pieces per hour. Its operations on a universal joint spider are as follows: 1) rough hollow mill and face; 2) finish hollow mill; 3) face; 4) drill; 5) center. Inquiries on special drilling machinery are invited.
Inform-A-Gram No. B139.

TACHOMETER INDICATORS. Tachometer Generators and Electric Hand Tachometers are made by The Electro-Mechano Co. The new E-M Generator eliminates rotating coils, magnets, contacts and brushes. Further information is obtainable from the company.
Inform-A-Gram No. B140.

MODEL 6-12 SURFACE GRINDER, a small machine that will do much of the work usually done on large grinders, is featured in a current Boyar-Schultz Corp. folder.
InformA-Gram No. B141.

LUFKIN PRECISION TOOLS, for accurate, quality-control measuring, are presented in the company's interesting Catalog No. 7, now offered.
Inform-A-Gram No. B142.

THE "HARDSTEEL" OPERATORS' MANUAL, a helpful, 20-page booklet, includes applications, drill speeds, drilling procedure, use of jigs and coolants, and other data pertinent to the use of Black "Hardsteel" Drills, made by Black Drill Co.
Circle Inform-A-Gram No. B143.

LUCAS PRECISION HORIZONTAL BORING, Drilling and Milling Machines incorporate three speed ranges to a single spindle, and vibration-free drive. Descriptive literature has been issued.
Circle Inform-A-Gram No. B144.

THE HAMILTON No. 1 GEAR HOBBER, designed for the forming of small, super-accurate, spur, bevel, worm and face gears, is completely illustrated and explained in Bulletin H 1-49.
Circle Inform-A-Gram No. B145.

(Continue reading PUBLICATION PREVIEWS on page 144)

BECKETT AIR POWER
DRILL PRESS FEED
Taps Extruded Holes In 16 Gauge Steel with Multiple Drill Head!

NO LEAD SCREWS!
NO TAPPING HEAD!
NO CLUTCHES!
NO CHECKING DEVICES!

JOB DATA FROM:
Metal Industries, Inc.
Youngstown, Ohio.

JOB:
Tap two extruded holes in 16 gauge, C.R. Steel refrigerator bracket with 10/32" tap.

EQUIPMENT:
Small drill press equipped with multiple drill head and BECKETT AIR POWERED DRILL PRESS FEED AND TAPPING CONTROL.

PRODUCTION:
1100 pieces (2200 holes) tapped per hour. Class 2 thread. No tap breakage!

Beckett Air Powered Tapping Feed uses only sufficient air pressure to move the tap to the work. There is no forcing of the tap—tap is its own lead. After tap is through the work, motor **instantly** reverses and tap leads itself out, **without stripping the last thread!** Tapping depth controlled to 0.001". Tap at the same r.p.m. used for drilling the material.

Many manufacturers are now using BECKETT AIR POWERED FEEDS on tapping jobs formerly done on expensive tapping machines —**with far more and better** production at **great savings!** Get full details today. Write for Bulletin No. 20.

BECKETT - HARCUM CO., 1146 Wayne Road, Wilmington, Ohio

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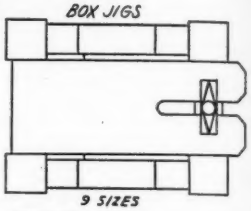

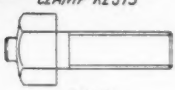

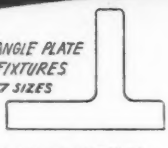

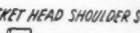

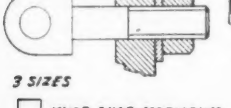

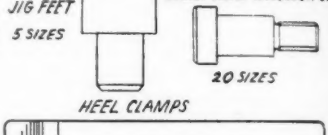

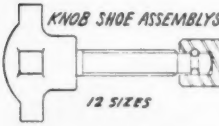

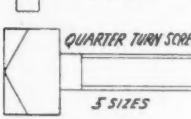

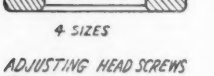

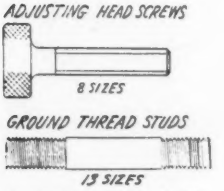

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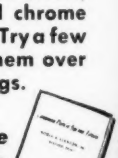

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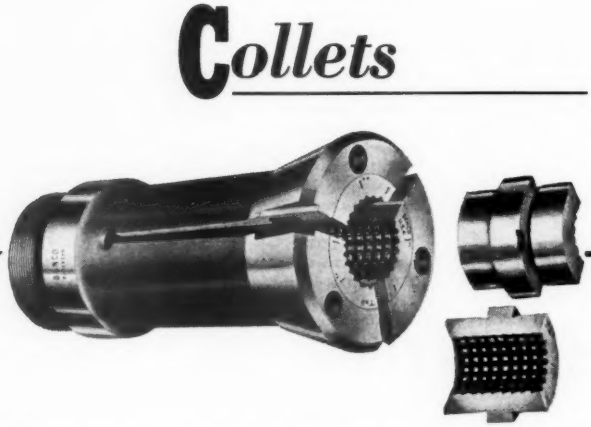
The A B C of better production

Accurate Benco Collets



●Reduce your cost and inventory by using Benco Master Collets and pads—obtain solid collet service at the price of collet pads. Without removing the Benco Master Collet from the machine, the pads may be quickly changed, thus giving a wide variety of collet sizes up to the fullest capacity of the machine. Pads in the Benco Master Collet are held firmly in place by Allen set screws, and by simply loosening them the pads may be removed while collet remains in working position. Draw-in type Benco Master Collets use a pad that can be interchanged with any other pad intended for Benco Master Collets of the same machine capacity regardless of make of machine. Write for full information about these exclusive Benco features.

Benco Master Collet is used as standard equipment by National Acme Company. Benco and National Acme "CB" collets and pads are interchangeable.

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October • Buyers' Guide • 1950

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. . . . . **Quality Control School**

Quality Control

Following the plant tour, the Quality Control course covers the principles of inspection technique, including the use of frequency distribution and correlation charts, production control charts, quality reports, load testing and sampling. A lecture illustrated by 50 slides then explains the inspection problem in parts buying and approaches to its solution. The material presented in these sessions is based upon presentations made before meetings of the American Society for Quality Control.

The second day of the Quality Control course includes lecture and discussion on spring specifications, load testing of springs, sampling and reporting, testing practice and a discussion of the Neg'ator, Hunter's new elastic member with negative force-deflection characteristics. During the session on testing practice, participants in the course are divided into groups of two and each group is given a Baldwin-Hunter spring tester. Each group sets up a tester, tests an entire sample of springs and records the test data in frequency-distribution form. In this manner, m o d e r n practice in spring testing and the result, the frequency-distribution chart, become familiar to each participant.

In addition, the session on load testing of springs includes demonstrations of several commercial devices used for special tests. Testing procedures and results, the design of quality reports and sampling techniques are clearly outlined and discussed in their function as inspection tools.

The two-day session is concluded with a lecture, "Management Experience With the Statistical Method." by P. C. Clarke, Assistant General Manager. Mr. Clarke's discussion relates production control, cost control, quality control and inspection techniques as they appear in the eyes of industrial management. Various problems, solutions and results obtained are discussed; case histories are presented to stress the function of the statistical method in the management picture.

Spring Design & Specifications

After the plant tour on the morning of

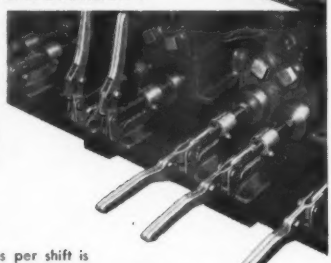
$100

"DE-STA-CO" CLAMP INVESTMENT

saves over

$5000

each shift per year



A saving of 12 man-hours per shift is reported by ***Ross Operating Valve Company*** with this fixture, built around 24 "De-Sta-Co" Model #620 Toggle Clamps.

Photos courtesy Ross Operating Valve Co. Detroit, Mich.

The fixture holds ***Ross*** 4-Way air operating valves during a "run-in" operation. The clamp plungers are tipped with rubber grommets which seal exhaust and intake ports during the "run-in," after which the valves are torn down and inspected carefully. Besides the actual saving in man-hours, these "De-Sta-Co" Toggle Clamps convert a tedious setup job into one quickly and accurately performed by less highly-skilled labor.

For your problem in production work-holding there's a "De-Sta-Co" Toggle Clamp that assures increased efficiency, accuracy and savings. Whether you're machining, welding, gluing, bonding, inspecting or assembling, you do it faster . . . and cheaper . . . with "De-Sta-Co" Toggle Clamps. Our catalog describes more than 40 fixture and portable models, holding capacities over 2500 lbs. Write for your copy today, and name of nearest "De-Sta-Co" distributor.

DETROIT STAMPING COMPANY

1344 MIDLAND AVENUE
DETROIT 3, MICHIGAN

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

the first day, the Hunter course in Spring Design & Specifications is launched with a discussion and demonstration of unique spring design problems.

Following a discussion of various spring materials and design stresses, separate sessions are held in compression spring, extension spring and torsion spring design procedure. In the belief that spring design and inspection—the first and last steps in spring manufacture—are continuously related functions, a session on inspection and testing has been included in the Spring Design & Specifications agenda.

Included in the sessions on spring specifications and tolerances is a discussion of the do's and don'ts of spring design with respect to spring performances. A discussion of production and shipping aspects such as plating, tangling and heat treatment follows.

Although each session in both courses is organized as to subject material and time, one of the features of the Hunter plant courses is the informal discussions with Hunter personnel during and between sessions. The participant is able to discuss aspects of the courses of particular interest to himself and his company.

There are no examinations, quizzes, or tuition; lecture and demonstration are the forms on which each session is built. Some acquaintance with inspection procedures is useful to those participating in the course on Quality Control, while the participants in the course on Spring Design & Specifications have some understanding of strength of materials.

Some indication of the success of the Hunter Spring Company's program is given by the attendance figures in the last two years. In the Quality Control course, 256 men from 104 companies have attended 28 two-day classes, while 157 men from 87 companies have attended the 16 classes in Spring Design & Specifications. Large and small companies from virtually all corners of industry are represented by "graduates" of the Hunter courses.

THE FIRST NEW IDEA IN
DRILL JIG BUSHINGS...
SINCE
HECTOR WAS A PUP!
MEYCO
Carbide Inserted Bushings
SAVE money 7 ways:
Talk about "earning their keep," look at the ways Meyco Carbide Inserted Drill Jig Bushings will save production costs: (1) Last longer . . . with a life—in most cases—as long as solid carbide bushings at prices that come close to the prices of ordinary steel bushings; (2) Increased life for your drill jigs and fixtures; (3) Increased life for your drills and reamers; (4) Accuracy maintained for a LONG PERIOD of time; (5) Less non-productive machine time, less lost man hours, because bushings need not be changed as often; (6) Inspection time saved, because of greater accuracy for a longer time; and (7) Less waste due to spoilage, for the same reason. MOTORMAKER SAYS: "High-Speed steel bushings averaged ten days' life, MEYCO bushings, after three months' use, show no signs of wear."
For information and prices write for Meyco Bushing Catalog No. 17.
W. F. MEYERS CO., INC., BEDFORD, INDIANA

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MILWAUKEE DIE FILERS PROFILE GRINDERS

Cut Tool and Die-Making Costs!

DIE FILER
Model FS with new All-Purpose, Deep - Throated Overarm performs all tool and die - making operations at low cost.

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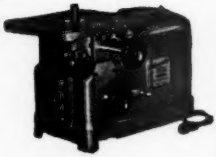

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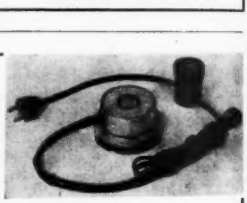

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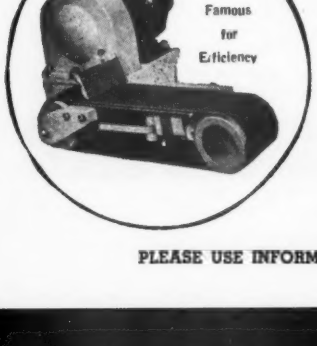

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this series of tools is pratcical and, for a considerable part, simple to apply. Once the director of the program has studied the case at hand, selected the proper tool, made the analysis, and interpreted it, the rest is simple. The everyday use can be, and is being, carried down to the worker right on the job or the machine. Simple eighth grade arithmetic handles many cases; mere tally marks on a form provided take care of some, while simple charts provide a picture in other cases. No particular educational background is required by those who are going to do the work; brief and simple explanations suffice to get a project under way. The work required can almost always be performed by people already on the job, though some reassignment of duties may be necessary. Data may have to be collected in a different manner and form than at present, but usually with less work rather than more.

The whole secret in the case of a manufactured article, for example, lies in controlling the quality DURING PRODUCTION rather than trying to sort out unacceptable quality after the part or assembly has been completed. For materials receiving inspection an unbiased evaluation of quality level is assured; the same applies to outgoing quality level. Throughout the many process controls, design, production phases, etc., fact replaces opinion. This entire system might well be called "Management by Fact Instead of Opinion." If the underlying principles are accepted on faith, (you can prove them all to your complete satisfaction if you wish to take the time) and a competent individual is at hand to guide the program and interpret the results, the utilization of these techniques should present but few problems. Authoritative literature ("Industrial Quality Control", official publication of the American Society for Quality Control, as an example) contains a host of "success stories". Discussion with individuals in organizations which have been using Q. C. will produce hundreds more. It is no longer a questionable subject; it is still controversial but definitely proven

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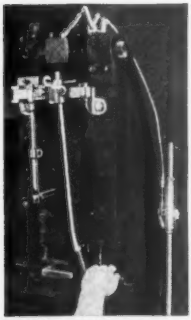

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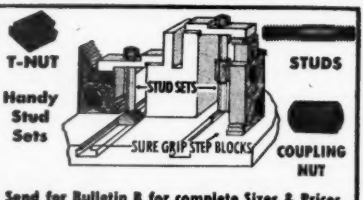

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and established. While there is still no substitute for experience, the present day industrial pace decrees that experience is materially enhanced by the utilization of proper tools.

One of the broad fields of development that has been activated by Q. C. is that of the measurement field. Factual analysis has proved the necessity for better, faster, more concise measuring devices. These are being rapidly developed, and the effective use of some of the modern tools is almost entirely dependent upon Q. C. systems. The modern gaging field is a far cry from the conventional scale and hand micrometer, and its progress has closely paralleled that of Q. C.

Another field notably affected is that of in-plant training programs. Q. C. has become so important to some large industrial organizations that they have revised their supervisory training ideas.

What are some of the "quick and easy" results of a properly designed, carefully applied Quality Control program? Reduced inspection costs and reduction of scrap and rework are the most prolific. If the system is properly handled throughout it is simply axiomatic that improved product quality and reduced costs simultaneously result. Associated with the foregoing is almost inevitably reduced lost or idle time, hence improved production with the same equipment and man-power. Conservation of materials, tools, equipment, man-power and space are simply "naturals" and go hand in hand with better quality at lower cost.

The properly designed and executed program brings an inevitable improvement in supplier-purchaser and vendor-customer relationships. A common ground of understanding and an unbiased appraisal and measure of quality accomplishes this. There are cases on record where a supplier actually reduced his price on a commodity, after his customer helped him become acquainted with Quality Control to the end that his producing costs were materially lowered. The ability to produce a more uniform quality of a higher standard enhances the standing of the supplier; the availability of a more reliable and predictable quality

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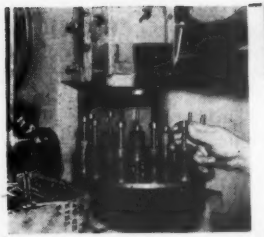

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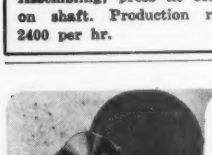

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pleases the purchaser. Throughout the pages of this QUALITY CONTROL Feature Issue of TOOL & DIE JOURNAL you will find examples of how these things have been accomplished.

The tools in the kit bag of Quality Control are not limited to inspection problems nor to the controlling of the quality of a manufactured article. Far from it! By controlling the quality of an article DURING manufacture it is possible to insure meeting a definite standard of quality at the finish, but this is merely one of the phases of application. Recent experiences indicate there is absolutely no phase of the complex modern industrial enterprise which cannot in some manner be aided by one or more of the many tools of Quality Control. There is presently considerable activity in the field of engineering design, sales analysis, accounting, personnel, research, purchasing, specification, maintenance, inventory controls and many others.

Some of the less tangible returns come in such things as improved employee relationships; relations between foreman and workers, foreman and supervision, design and production, production and inspection, and sales. These may be a little slow to manifest themselves but they are inevitably rewards of the carefully and thoughtfully nurtured program. They originate first from increased earnings, then better understanding of the individual job, of the department, or company problems. They are fostered by action taken by management to correct a situation beyond the control of a workman, a situation, not hitherto realized as Management's responsibility. Thus an improvement in management-labor relations is another potential gain. Few would probably acclaim this as proveable, but there are some who do so claim and can prove it.

The attention created in such quarters as Wall Street Journal, Business Week, National Industrial Conference Board Reports, Fortune Magazine, and other similar management publications, should be the best possible evidence of its interest to top management. Incidentally, top management understanding and ap-

(Continued on page 132)

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tangible and intangible benefits will be obtained are highlighted.

The first thing that will be gained from the quality control program is a revamping of inspection procedures, practices, and methods. Any inspection department not using quality control and which does not 100% inspect the products, is using guess work and old, time-worn, rule-of-thumb practices, some of which are satisfactory but many are very poor indeed. In no case do they have methods by which quality can be **unconditionally guaranteed.**

As applied to the acceptance and rejecting of lots of items, quality control is nothing more than scientific, economic sampling. Certainly if sampling is employed it should be done according to definite methods. Figures 1, 2, and 3 are the instruction sheet, the sampling tables, and a parts sheet taken from our Machine Shop Inspector's Parts Classification Book. Organized inspection procedures result from quality control work.

The second benefit from quality control will be a thorough analysis of piecepart and assembly tolerances and specifications and this approach to tolerances is invariably an eye-opener to all concerned. Statistically determined tolerances and specifications provide a common meeting ground for design, methods, production, inspection and sales. Diverse opinion and controversy is practically eliminated.

The third benefit from quality control will be an accurate appraisal of the ability of measuring equipment to do the job for which it was intended and this again is ordinarily quite an eye-opener. Most plants find their equipment woefully inadequate.

Most companies maintain a goodly volume of records on production, rejections, scrap, tool and die repairs, costs, etc. These records can be exceedingly valuable when properly summed up, charted or graphed and accurately interpreted. The quality control engineer will do this in the normal work course.

There are many other areas in which quality control techniques can be used to advantage but the ones mentioned are the spots where most concerns will find the best returns from quality control.

If there is any one point that needs emphasis most it is this: DO NOT SKIMP ON THE QUALITY OF PERSONNEL IN YOUR QUALITY CONTROL GROUP OR DEPARTMENT.

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For nearly 50 years the Pittsburgh Tool Steel Wire Co. has specialized in the cold finishing of steels generally, but more particularly in the finer grades for tools and dies and other purposes of a highly exacting nature. Their staple product has always been drill rod—accurate flawless, hardenable steel.

The company now produces four standard grades of round drill rods, of which two are water hardening — Monaca (1.25% carbon), and Dukane (1.00% carbon). The others are High Speed (18-4-1), and Warplis oil hardening (C. .90, Mn. 1.10, Cr. .50, Tungsten .50, Va. .15).

Reliance cold drawn flat and square drill rods are produced by the company in 184 standard sizes 3/32" x 1/16" flat and larger, and 1/16" square and larger. This is a water hardening tool steel grade of .90-1.00% carbon.

Latest addition to the Pittsburgh line is Warplis Flat Stock. The advantages offered for many years in Warplis oil hardening drill rod rounds are thus available, for the first time, in flats and squares. Warplis Flat Stock comes in 156 standard sizes 1/64" to 1¼" thick up to 10" wide in 18" stock lengths. Each piece is precision surface ground on all four sides, accurate, square and true.

Warplis Drill Rods (rounds) are precision centerless ground, and the stock length is 36". Both products are accurate to size and of flawless finish, eliminating all tedious, time-consuming, metal-wasting "get-ready." Write for descriptive literature to PITTSBURGH TOOL STEEL WIRE CO., Dept. TDJ, Monaca, Pa., or

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preciation as well as enthusiastic and aggressive backing is essential to the real success of any program.

The institution of a carefully thought out and planned program can be practically guaranteed to sharpen up decisions, point out trouble before it happens, indicate where the trouble spots are, replace "guesstimation" with exactitude, assist in making the best possible use of available time, uncork the bottlenecks, help solve the problems that have apparently defied solution, and enable one to go farther than has heretofore been possible. This makes Q. C. sound like a panacea. It has not been so claimed nor should it be so construed but its contribution as a fortification to modern management is far from problematical; it is factual.

* * * * *

produce parts within the required tolerance of $\pm$ .003", since 3 σ is equal to or less than .003" for each cavity. However, the majority of the parts are oversize on the 0.245" dimension. This means that the cavities are too deep; each cavity will have to be "closed up" an amount equal to the difference between 0.245" and the average of the parts produced by that cavity. That is, cavity #1 should be closed .002"; cavity #2 should be closed .008"; cavity #3 should be closed .013"; and the other cavities a corresponding amount. (See Table, Figure 3).

Fig. 4. Results of reworking mold.

Average and Standard Deviation of Each Cavity After Mold Was Reworked			
Cavity No.	$\bar{X}$	σ	3σ
1	.2444	.0006	.0018
2	.2446	.0005	.0015
3	.2442	.0009	.0027
4	.2460	.0012	.0036
5	.2454	.0008	.0024
6	.2461	.0008	.0024
7	.2446	.0009	.0027
8	.2442	.0007	.0021
9	.2444	.0009	.0027
10	.2432	.0006	.0018
11	.2436	.0008	.0024
12	.2458	.0006	.0018
13	.2441	.0007	.0021
14	.2445	.0007	.0021
15	.2453	.0007	.0021
16	.2450	.0006	.0018

Therefore, the mold was returned to the tool room with this information and each cavity was reworked accordingly.

After the mold was returned to production, another pilot run was made with the results shown in Figure 4. It will be noted that the standard deviation continues to show that the process is able to produce parts within the required tolerances. The average, $\bar{X}$, for each cavity shows that it is very close to the nominal dimension specified on the drawing for the part. Therefore, we now have assurance that no defectives will be produced from this operation, and detail inspection can be waived, a cost reduction.

In this case history the standard deviation (σ) was used instead of the range, R, as a measure of dispersion. The standard deviation is somewhat more efficient for making an analysis of a pilot run, and its use is recommended for this purpose.

The slightly larger standard deviation shown for cavity #4 was due to operating conditions which were corrected.

This method of proving tools and dies has resulted in a substantial reduction in manufacturing costs. It has meant more realistic production schedules, and inspection has been reduced considerably, since the need of detail inspection has been completely eliminated. It is necessary to do only enough inspection to determine mold wear, and this is controlled by running an $\bar{X}$ and σ chart on the operation with samples of five taken from each cavity twice each shift.

* * * * *

Dickerman Adds Space

A new plant addition of approximately 5000 square feet is announced by H. E. Dickerman Mfg. Co., Springfield, Mass. This addition will enable the company to step up production of Dickerman Automatic Punch Press Feeds. Introduction of the Rol-Di-Feed a year and a half ago, combined with an increasing volume on hitch and die feeds, has crowded present manufacturing facilities to the limit.

Radius Dresser

- Designed to meet the demand for an inexpensive Radius Dresser for medium size surface grinders.
- Capacity: 2½" concave, 1⅜" convex.
- Overall dimension: 6"x6"x3".

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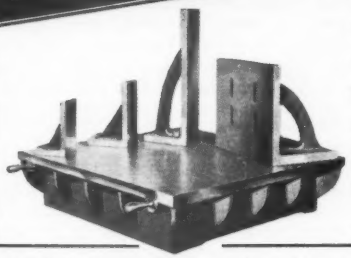

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scale are possible in addition to errors caused by vibration, temperature changes and the rectangular coordinate system.

As in rectangular coordinates, an angular zero, or reference, is used. Care should be used in taking any specific hole as a zero, for the same reason as that for taking any hole, or row of holes, as a reference in rectangular measurements. There is as much chance of error in machining or checking at the zero point as anywhere else.

The system best suited to checking work in a rectangular locating system and indicating each hole over its entire surface is the jig borer or jig grinder.

The toolmaker's microscope is also excellent, provided all holes have sharp edges. In some cases, especially in holes too small to approach with the indicator, checking is done more effectively with microscopes. Used on the jig borer or jig grinder, these attachments convert the machines into efficient inspection machines.

The preferred type of indicator is that with the extension lever-type tip. Usually a "thousandth" indicator is sufficiently sensitive. Since the hole is indicated all around, any locational error is doubled on the indicator dial. This compensates for the high magnification in the "tenth" indicator. In fact, unless held very rigidly, the "tenth" indicator loses as much in sensitiveness because of its internal friction as it gains from magnification.

Recommended practice for checking is to set the table position so the indicator reads true all around the hole. Run the indicator up and down in the hole to obtain a good average reading. Compare the actual table setting with the calculated coordinates to which settings were made during fabrication. Differences between figures represent actual errors.

Due to the causes mentioned previously, slight errors will be found. Usually they will be in one direction, all plus or all minus, and indicate that a temperature change moved the whole coordinate location system during the time elapsed between machining and inspecting. These errors cancel themselves out by slight parallel re-orientation.

In addition to saving time, the jig borer and jig grinder greatly increase the capacity of the tool inspection department. Considerable inspection equipment is still necessary, but a good deal of it is supplanted by the use of the jig borer and jig g r i n d e r as inspection machines.

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A product is only as good as his try
To make it a product that catches the eye,
And takes the wear an article should.
Brother, today it has to be good.

Appearance and comfort are stressed more today
Because they pay off in many a way.
Where Quality rules, wages are high,
Because they produce a Quality buy.
Stockholders profit as dividends grow,
And you don't hear them say "Business is slow."

Queen Quality rules, and don't forget
That a Quality shop is a sure-fire bet.
The public is willing to buy the best
But it must live up to the Quality test.
You haven't a chance if the goods you produce
Fail when the buyers put them to use.
They've got to Quality with a capital "Q."

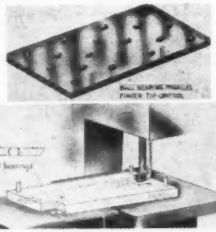
Whether it be cars or vegetable stew.
The buyer is King; Queen Quality has ruled
That the public does not intend to be fooled.

* *by Al Mickelson, Supervisor, Expediting Section, Central Purchasing, Ford Motor Company, Dearborn, Michigan. Reproduction, courtesy Guil Rothfuss, Editor, Ford Motor Company's "Quality Control News."*

BALL BEARING PARALLELS

Another big time saver when DRILLING and SAWING

Write



TIETZMANN TOOL CORP.

P. O. Box 122, Englewood, Ohio

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HIGH SPEED CUTTERS
TUBE BURRING FILES

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ROTARY FILE COMPANY

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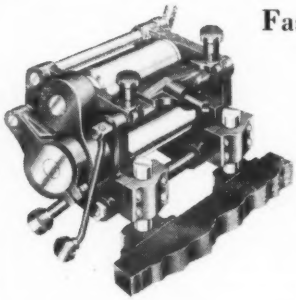

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IS ASSURED WITH

WHYTE ROLL FEEDS

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WHYTE

ENGINEERING COMPANY

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PAT. PEND.

TYPE TD

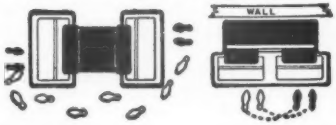
10 TD 10" 14 TD 14"

TWIN WHEEL TOOL GRINDER

(Also single cup wheel)

FROM ROUGH TO FINISH GRIND IN ONE STEP

HEAVY DUTY WET OR DRY 10" - 14" WHEELS



OLD WAY	NEW WAY
Lost time between rough and finish grind.	*One step from rough to finish grind.*
Floor space wasted—Grinder must be away from wall.	*Conserve floor space—place Grinder against the wall.*

Positively no spray or splash when grinding wet !

WRITE TODAY FOR BULLETIN 18

See this machine in operation at Booth 2101, National Metal Exposition and Congress, Oct. 23 to 27, Chicago, Ill.

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HIGHEST QUALITY . . . .
AT LOWEST PRICE

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6" and
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Scales
.001" and
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Men, Machines & Jobs

A year by year (1910 to 1950) study of the effect on employment of production workers of installation of so-called "labor-saving" equipment in U. S. industry is contained in an eight page booklet just released by the Michigan Tool Company. All figures in the booklet were compiled from figures in the files of the U. S. Department of Commerce (data re machines) and the U. S. Department of Labor (employment figures).

Copies of the booklet are available by writing Michigan Tool Co., 7171 E. McNichols Road, Detroit 12, Michigan.

STOP DUST
with
DUSTKOP

- 22 models
- Low Cost
- Immediate Shipment

Aget-Detroit Company
213 Main St. Ann Arbor Mich.

DRILL BREAKAGE
Reduced 86.7%

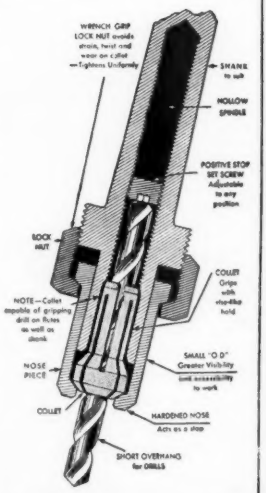
Here's How It Was Done!

Large automobile manufacturer famous for production efficiency, gave us the following report of a test of the Erickson Collet Chuck. As a result of this test, manufacturer has standardized on Erickson Collet Chuck for this operation.

"Erickson chuck is used for drilling 1200 vent holes per day, average drill breakage one per day. We formerly broke from 8 to 10 drills with the ——— chuck. Now have average breakage of 2 drills per 900 oil holes drilled in pistons with 1/4" Erickson chuck. Had breakage of 15 drills per 900 holes using old drill sleeve method." Learn how this efficiency can be yours, too! Send for complete data on Erickson holding equipment now and learn how Erickson tools applied to your problems can boost production and reduce costs.

NO OTHER COLLET CHUCK ON THE MARKET

1. Delivers accuracy of .0005" TIR.
2. Permits collapse of 1/32" (Replacing 7 standard single purpose collets)
3. Grips drills on flutes — permits stubbing
4. Gives such positive grip due to exclusive surface contact.


WRENCH GRIP LOCK NUT avoids strain, twist and wear on collet — Tightens Uniformly
SHANK to suit
HOLLOW SPINDLE
POSITIVE STOP SET SCREW Adjustable to any position
LOCK NUT
COLLET Grips with min-thin hold
NOTE—Collet capable of gripping drill on flutes as well as shank
SMALL "O.D." Greater Visibility and accessibility to work
NOSE PIECE
COLLET
HARDENED NOSE Acts as a stop
SHORT OVERHANG for DRILLS

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Shipped on 5 day aproval

Immediate delivery

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Plainville, Conn.

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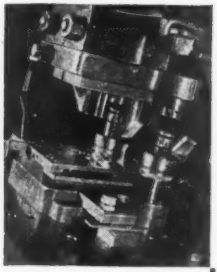
WHEN BUILDING DIES

This new method of checking tapers on dies does away with die squares and height gauges.

Write for complete details

Tietzmann Tool Corp.
P. O. Box 122, Englewood, O.

STOP WEAR on Die Sets



. . . with ACRO Pin Oilers

Acro Pin Oilers, as illustrated, fit over each leader pin and seals in place with a rubber neoprene washer. Each cup is filled with oil so each downward stroke brings bushing in contact with oil and each upward stroke distributes oil evenly over leader pins. Eliminates bushing wear, leader pin scoring, and maintains die accuracy.

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Ask for Bulletin TD-30. describing Acro products

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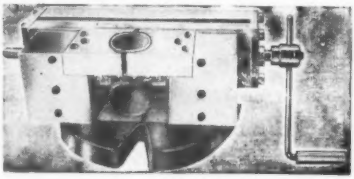
A PRODUCTION WORK HOLDING TOOL made in three sizes for Drill Presses—Tappers—Drilling Machines—Assembling Fixtures—Multiple Operations of various kinds.

The JOHN'S DRILL JIG



Designed for production work on piece parts from ⅛" to 6" width and for almost any length.

- Economical
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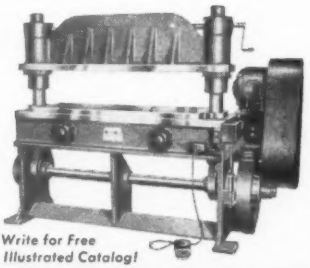
Multi-Max Punch Presses

. . . for Fast Production on Light-Gauge, Large-Panel Metal Stampings.

- 30 TONS RATED CAPACITY
- 80 STROKES PER MINUTE
- BED AREA: 16" x 48"
- WEIGHT: 4,150 LBS.



DIAMOND MACHINE TOOL COMPANY
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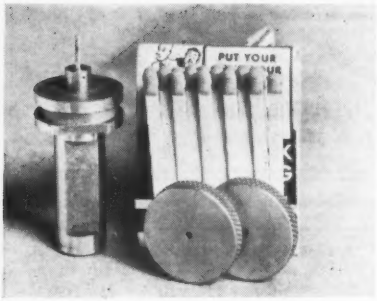
SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

Air Gaging Today



Many people criticize or overlook air gaging because of arguments which were valid a few years ago, but which have since been remedied. This has prevented many concerns from taking advantage of the economies of faster, more accurate gaging, made possible with air.

by F. Steel Blackall, III
Assistant Superintendent
Small Tool Division
The Taft-Peirce Manufacturing Company
Woonsocket, Rhode Island

It is probable that the rapid spread of Statistical Quality Control will bring much of this to an end, due to the new thinking regarding quality which it has engendered. Quality Control men, with a fresh point of view, will reexamine all methods of gaging available, irrespective of what old-time thinking may tell them. It is likely that their studies will erase much of the fallacious thinking that surrounds the use of many types of gages. In addition, of course, it will uncover some previously unconsidered disadvantages of these same gages, but the entire process, which actually has already begun, is certain to be a very healthy one.

One misunderstanding which is certain to fall by the wayside is that regarding the limiting dimensions of internal diameters measurable by air.

There is no doubt that many people feel that air gaging is inapplicable when internal diameters of under ⅛″ are involved. In fact, it is likely that some do not realize that even ⅛″ is obtainable.

The fact of the matter is that most prominent air gage manufacturers have been producing air plugs of as little as .100″ diameter for some time. Accompanying this article is a photograph of an air plug employed to measure a diameter of .058″! This particular plug has been in use successfully with a Taft-Peirce Comp-AIR-ator air gage set to a full scale range of .002″, scale increments being .00005″. Its two .013″ orifices are recessed below the outside diameter of the air plug by .0004″ on diameter.

This air plug and others like it have been found to give consistently accurate readings with excellent repeatability characteristics. In addition, of course, they have permitted a thorough check for taper and out-of-roundness, not possible with other types of gages used in the measurement of small internal diameters.

While this discussion has limited itself to but one example of "old-fashioned" thinking, and one which is rather specialized in application, let us hope that it will stimulate interest in a general re-examination of those characteristics of air gages which might falsely be considered as limitations or disadvantages.

★ ★ ★ ★ ★ ★ ★ ★

Small Business & Government Business

Don't go to Washington for a solution to your priority or allocation problems, if you are interested in bidding on government defense contracts, but go to the nearest field service office of the Department of Commerce of which there are 42 located in the principle cities of the U. S. Proceedures for you to follow to be placed on the "Invitation to Bid" list can be obtained at these field offices. This sums up the information given out at a Government-Small Business Conference in Cleveland in which officials of the Munitions Board, R.F.C., General Services Adm. and the Department of Commerce participated.

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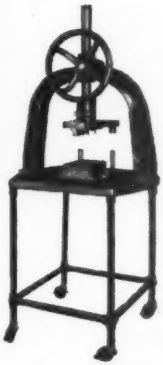

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Lacey Die-Set Machine

Here's a truly "one man" press. It operates with one hand. Handy for tool and press rooms, it permits the diemaker to complete a die-set right at his bench . . . saves toolroom and handling costs. Ask today for full details.

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COOLING ANTI-FRICTION COMPOUND

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SAVES WEAR ON MOVING PARTS

Find out how Motor Mica can put an end to your lubrication problems. Try it with your cutting oils, in die-casting, deep-drawing, metal stamping, etc. Write on your business letterhead for free sample. No obligation.

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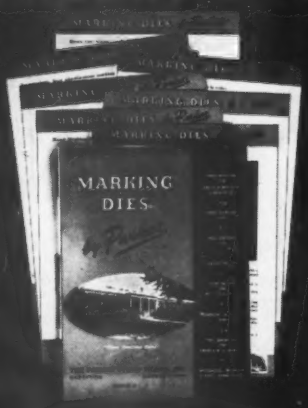
IF YOU USE MARKING DIES



SEND FOR THIS FREE CATALOG

Parker has been engineering and manufacturing Precision Marking Devices for over three-quarters of a century. Catalog #47 not only covers Parker's standard line of better, single and multiple character hand and press marking dies, but it also deals with specialized roll marking, graduating, embossing, coining dies and mechanical engraving. If your marking problem is unique, if it is only in the blueprint stage, whether you want to mark steel, brass, plastic, wood, or some other material, Parker offers you its complete design and engineering service so that your specific needs can be expertly and economically taken care of.

Now or for future reference, be sure there is a Parker Marking Die Catalog in your file.

WRITE TODAY

THE Parker STAMP WORKS HARTFORD, CONN.

CRAFTSMEN SINCE 1871

SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

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QUICK-PIC

BAND SAWS
The Famco No. 612 Metal Cut-Off Band Saw, in several models, is presented in this current literature. Specifications are listed.
Circle No. E1.

DIAL INDICATORS
The completely revised 3rd edition of the Starrett Dial Indicator Catalog contains 56 pages of descriptions, specifications.
Circle No. E2.

HOBBING
Diagrams and photographs illustrate an interesting discussion of hobbing featured in Barber-Colman's catalog. Hobbing machines are described.
Circle No. E3.

GRINDERS
Super Precision Bench Grinders provide the subject matter for a colorful brochure that is being offered by Crystal Lake Grinders.
Circle No. E4.

MIDGET MILLS
Catalog No. 18, from Severance, is actually a tooling guide, consisting of 32 pages of suggestions for use of Midget Mills, countersinks and other tools..
Circle No. E5.

THREAD GAGES
An up-to-date price list is a highlight of Perfex Gage & Tool Co.'s 8-page catalog. Reversible thread gages, pipe thread gages and others are included.
Circle No. E7.

DIE SETS
Complete die set data, including dimensions and prices, can be found in a new four-page bulletin issued by Union Mfg. Co. It is illustrated.
Circle No. E6.

CUTTERS
Tomkins - Johnson's line of die sinking milling cutters is covered in the new 32-page Catalog 150. Illustrations, prices and standards are incorporated.
Circle No. E8.

MEASURING
Electronic measuring equipment, which makes quality control easier to achieve, is described in an attractive Brown & Sharpe publication.
Circle No. E9.

SHAPER
Want the latest in crank shapers? Bulletin 5021 details the Steptoe-Western High Speed Shaper, with 18 all-geared speeds, V-belt drive.
Circle No. E10.

MARKING DIES
Sixteen pages of pictures, descriptions and prices of Parker Stamp Works' marking dies make up the useful catalog now being mailed.
Circle No. E11.

AIR GAGE
This very comprehensive booklet from Taft-Peirce deals with applications and accessories of the new T - P Comp AIRator Air Gage.
Circle No. E12.

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CATALOGS

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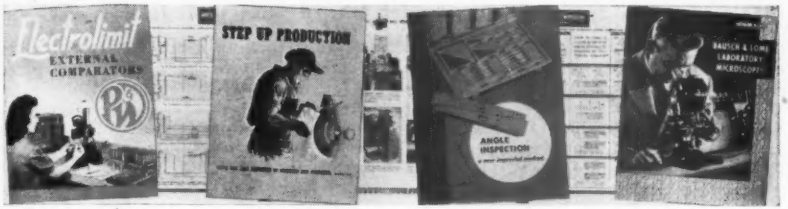


EXTERNAL COMPARATORS
P & W Electrolimit External Comparators are the subject of a highly illustrated, 20-page circular, No. 481.
Circle No. E13.

ABRASIVE BELTS
Case-history examples and data on grinding and polishing with abrasive belts are included in a helpful, 36-page, 3M company booklet.
Circle No. E14.

ANGLE GAGE BLOCKS
Angle measurement accurate to millionth parts of a circle is made simple in Webber's "Angle Inspection" brochure.
Circle No. E15.

MICROSCOPES
A standardized method of model designations is a feature of Bausch & Lomb's 24-page catalog, D-185. Attractively illustrated.
Circle No. E16.

MICROMETERS
Precision micrometers of all types are pictured and described in a current bulletin published by Swedish Gage Co. of America. Prices of all are listed.
Circle No. E17.

AUTOMATICS
Are your automatic scew machines obsolete? This timely Brown & Sharpe brochure poses the question by comparing new B & S models with older machines.
Circle No. E18.

FINISHING
Hammond's Catalog 50 describes Super Model K-46-6 indexing Rotary Automatic Finishing Machines, other models. New model has variable work spindle speeds.
Circle No. E19.

MAGNIFIER
The "Flash-O-Lens" is an illuminated magnifier that spotlights the work as it magnifies. A new brochure from E. W. Pike Co. contains all the details.
Circle No. E20.

AIR EQUIPMENT
Cylinders, arbor presses, valves and vises are among the many types of industrial air equipment shown in Air-Mite's 16-page catalog.
Circle No. E21.

TURRETS
Enco Mfg. Co. has issued a colorful new catalog on turrets, toolposts, tailstock turrets, hexturrets, etc. Typical applications are pictured.
Circle No. E22.

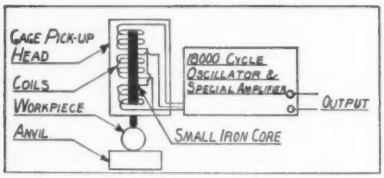
TUBE FITTINGS
Just off the press is Flodar Corporation's Catalog No. 500 of standard (JIC) hydraulic tube fittings of both the flare and no-flare types.
Circle No. E23.

GAGES
Charts giving practical information on gage tolerances, etc., are included in Cadillac Gage Co.'s extensive, 36-page catalog.
Circle No. E24.

SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

Electronic Measurement of Mechanical Changes

The basic operating principle of the Merz New-Tronic gage, built by Merz Engineering, Inc., of Indianapolis, is the transformation of minute mechanical movements into usable changes in an electrical potential. This is accomplished by electronically amplifying the output of a differential transformer located in the gage pick-up head. The transformer consists of a primary winding, energized by an 18,000 cycle oscillator in the instrument, and two secondary windings with a small iron core free to move axially in these windings. The output of the transformer is in direct proportion to the position and movement of this small iron core, which in turn is positioned by the part being gaged. The size of this transformer is small, being ½" in diameter and ½" long, thereby lending itself to the construction of small gage pick-up heads. An amplifier of special design is used to amplify and rectify the output of the pick-up head into a useful direct current potential.



The Merz New-Tronic gage, shown schematically, transforms minute mechanical movements into usable changes in an electrical potential. The d-c output is proportional to the core position. It can be used to operate a meter or a special relay circuit, to compare to another amplifier and in many other applications.

This dc output, which is in direct proportion to the core position or movement, can be used to perform many useful tasks. It can operate a meter as it does in the Merz New-Tronic Height Gages and Comparators. Mechanical changes as small as one millionth of an inch in the

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American DRILL JIG
BUSHINGS
AMERICAN DRILL JIG BUSHINGS
EXCLUSIVE DISTRIBUTORS IN EVERY MAJOR LOCATION THROUGHOUT THE U.S. AND CANADA CARRY ALL SIZES IN STOCK FOR IMMEDIATE FREE DELIVERY. YOU ARE ASSURED OF
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American Drill Bushing CO., INC.
5107 Pacific Blvd., Los Angeles 11, Calif.

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core position can be easily read on the meter. This is an extreme case and the customary amplification of this gage is 6250 to 1. Indicating lights can be added to these standard comparators for rapid production inspection.

The variable dc output can operate thyratron controlled relays and solenoids for the automatic segregation of machined parts at unbelievably high rates. Many of these machines are now operating at a rate of 10,000 parts per hour. In fact, the only limiting factor in the rate of sorting lies in the mechanical handling of the parts.

The output of two or more of these gages can be combined to give an average reading, as would be done in checking the average diameter of a part, or the reading of one gage can be electronically subtracted from another.

The output of two or more of these gages can be compared to give a reading which is the result of this comparison. For example, in the automatic checking for taper and barrel shape in automotive piston pins, three electronic snap gages contact the piston pin at either end and in the middle. If the output of these three gages are not equal, electronic comparison rejects the particular part.

Of interest to the quality control engineer is the fact that a chart recorder can be attached to the automatic checking machine, so that any or all dimensions being checked can be recorded. This recorder can give a 100% production record or can be arranged to sample production at intervals.

Of course, the simplest way to control the quality of a product is to prevent the machine from making bad parts. The Merz New-Tronic gages readily lend themselves to this application. The gage can be incorporated into the machining operation to shut down the operation, should a predetermined number of scrap parts be run in succession.

Because of its compact design, reliability and versatility, the Merz New-Tronic gage has found numerous and varied applications in controlling the quality of production of many different parts, and many new uses will be found in the future.

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TOOL STEEL SIMPLIFIED
By FRANK R. PALMER
President
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Chief Metallurgist
THE CARPENTER STEEL COMPANY
$2.00 Postpaid in U.S.A. $2.50 Elsewhere

Easy-to-understand explanation of how to select and heat treat the right tool steel for each job! 564 pages of plain, practical information on how to improve tool and die performance, simplify heat treating, lower unit costs! 355 illustrations . . . 21 data-crammed chapters that help make your everyday job easier and more valuable!

Discover how the new, enlarged "*Tool Steel Simplified*" can help *you!* Yours *at cost* . . . order today as many copies as you need!

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PUBLICATION PREVIEWS

CARBIDE DUALOCK ADJUSTABLE THREAD RING GAGES are excellent for master or reference gages because they have the long wearing qualities and stability required. Pratt & Whitney Circular No. 517 gives full details. Write to PRATT & WHITNEY, Div. Niles-Bement-Pond Co., 15 Charter Oak Blvd., W. Hartford 1, Conn.
Circle Inform-A-Gram No. B1.

FIXTURE CLAMPS BY WESPO, in 12 styles and 94 sizes, are the subject of a recently-published bulletin. West Point also offers exact scale template sheets.
Circle Inform-A-Gram No. B2.

THE SCHERR TOOLMAKERS MICROSCOPE, for coordinate measurement 4" x 2" and protractor ocular in minutes, is the subject of a current, informative folder.
Circle Inform-A-Gram No. B3.

THE IDEAL "XPAND-O-LAP" is a self-aligning, self-adjusting lap. It is accurate because the self-expanding principle maintains concentricity and alignment, even when sleeves become worn. An illustrated catalog has been published.
Circle Inform-A-Gram No. B4.

THE MULTI-MAX PUNCH PRESS CATALOG is being distributed by Diamond Machine Tool Co. The presses described are for fast production on light-gauge, large-panel metal stampings.
Circle Inform-A-Gram No. B5.

THE "CONE-LOK" JIG, featuring a locking mechanism that is guaranteed forever, is the subject of attractive literature issued by N. A. Woodworth Co.
Circle Inform-A-Gram No. B6.

3 NEW DIEBEL HI-SPEED AUTOMATIC PRESSES
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180 to 475 Strokes per Minute
with Built-in Precision Single or Double Feeds
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110 to 350 Strokes Minute
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2708 Irving Park Road, Chicago 18

HOVIS UNIVERSAL WASHER DIES provide a master holder and by merely changing five small, easily removable parts, the new washer or blank is produced. Thus, there is no need to make a complete new die for each type of washer or blank. Literature is offered.
Inform-A-Gram No. B7.

KIPP AIR GRINDERS provide the subject matter for Madison-Kipp Corp.'s colorfully illustrated Air Tool Catalog AT 3006. The speed of these grinders drops but slightly when put to work, meaning better work and longer wheel life.
Inform-A-Gram No. B8.

CHICAGO "SAFETY PLUS" SOCKET SCREWS are consistently accurate in dimensions and have sharp, smooth, true threads. They start in easily for the first time. Detailed literature is available.
Inform-AGram No. B9.

DRILLING HOLES of various shapes by an inexpensive method is explained in the latest catalog published by Watts Bros. Tool Works. Square, triangular, hexagonal, octagonal and pentagonal holes may be drilled.
Inform-A-Gram No. B10

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

V. P. D. TRANSPARENT PLASTIC HOLDERS are designed to prevent factory records, shop orders, blueprints and other production data from becoming messy, mutilated and unreadable. Now available is a 20-page Catalog Digest, No. 50, which illustrates and describes various types and sizes. Copies are procurable from JOSHUA MEIER CO., INC., 153 W. 23rd St., New York 11, N. Y.
Circle Inform-A-Gram No. B11.

PRODUCTION BORING with the Maxwell E-Z set line of boring heads is the subject of Catalog No. 30. Prices, capacities and specifications are charted for reference.
Circle Inform-A-Gram No. B12.

PRECISION LATHES, ideal for instrument work and second operations, are presented in Bulletin F, issued by Louis Levin & Son, Inc.
Circle Inform-A-Gram No. B13.

THE AIR-OPERATED ROTARY WORK FEEDER, made by Mead Specialties Co., holds and delivers small parts to drill, tap, swage, stake, etc. Stations are accurate to .002". Full details are found in the 1950 Mead Air Power Catalog.
Inform-A-Gram No. B14.

ACE DRILL BUSHINGS are precision-made and light-wave tested for .0003" maximum tolerance. Literature describing available sizes of these durable bushings may be had from Ace Drill Bushing Co., Div. of West Coast Aero Tool Co.
Inform-A-Gram No. B15.

HAND-CUT STEEL STAMPS, with letters and figures, are among the array of marking devices presented in the colorful Hoggson & Pettis general catalog. The catalog is conveniently thumb-indexed and is well illustrated.
Inform-A-Gram No. B16.

JIG AND FIXTURE PARTS. A 52-page catalog of drawings, specifications and prices is offered by Noble & Stanton, Inc. It covers their line of over 300 standard parts precision-made from quality steels.
Inform-A-Gram No. B17.

SOLID TUNGSTEN CARBIDE BURS are among the many burs and files described in Nicholson's new Catalog No. 3. Of special interest is the useful shop information included on proper speeds, uses and care of carbide tools.
Circle Inform-A-Gram No. B18.

RING PUNCHES are tough, hard and concentric. They are precision made of carbon vanadium tool steel. A handy data sheet, mounted on a card with a metal hanger, covers specifications and prices.
Circle Inform-A-Gram No. B19.

ALLOY STEEL SCREW PRODUCTS, stocked throughout the country for quick delivery, are pictured and described in Strong, Carlisle & Hammond Co.'s 20-page catalog. Dimensions and prices are listed.
Circle Inform-A-Gram No. B20.

Drill Hardened Steels without Annealing—

With the new, improved "HARDSTEEL" Drill, you can do accurate, smooth drilling, countersinking, counterboring and reaming in steels hardened by any process without first annealing the work. And they work with equal ease on work-hardening steels and high carbon—high chrome steels of any degree of hardness.

"HARDSTEEL" Drills fit standard drill presses. They save time and reduce rejects. They permit engineering changes requiring additional drilling after hardening. And parts drilled after hardening always match at assembly.

Write for a copy of the "HARDSTEEL" Operators Manual showing how "HARDSTEEL" drills are cutting costs in thousands of plants.

You Harden It—We'll Drill It—With "HARDSTEEL"

BLACK DRILL COMPANY
Division Black Industries
1368 East 222nd St. • Cleveland 17, Ohio

Also makers of— BLACK DRILLING UNITS—AUTOMATIC, SELF-CONTAINED—FOR COST-CUTTING PRODUCTION ON ALL MATERIALS
Write for information

SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

PUBLICATION PREVIEWS

MANY TYPES OF CUTTING TOOLS, hardened by the "Mastercasing" super-heat-treating process, are described in a current bulletin. Some of these are high speed tool bits, cast alloy tool bits, cut-off blades, recessing tools and stub screw machine reamers. Dimensions and prices are listed. Write the manufacturer, TRI-JAY MASTERFORM TOOL CORP., 6314 Northwest Highway, Chicago 31, Ill., and ask for Bulletin KE-AM.
Circle Inform-A-Gram No. B21.

BLUE LAYOUT DOPE, made by Tamms Industries, Inc., speeds layout on all metals. This fast-drying, oil-resistant fluid will not chip, crack or flake off. Free samples and descriptive literature may be had from the manufacturer.
Circle Inform-A-Gram No. B22.

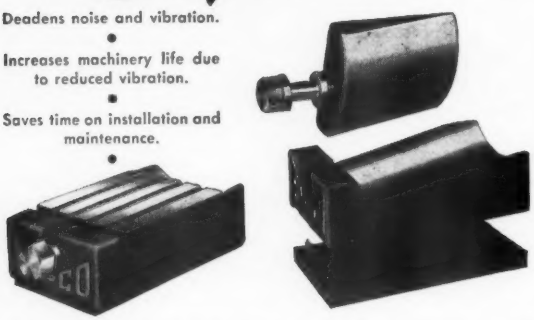
MAGNA-VISE holds any rigid non-magnetic material firmly in place on your magnetic chuck, permits you to take full advantage of magnetic chucking for brass, aluminum, copper, etc. The manufacturer, Hanchett Magna-Lock Corp., offers detailed literature.
Circle Inform-A-Gram No. B23.

HARDNESS TESTING for all kinds of applications can be done with one of The Shore Instrument & Mfg. Co.'s Scleroscope models. Illustrated literature covering these instruments is available.
Circle Inform-A-Gram No. B24.

DRILL JIG BUSHING DATA, intended to to make drill jig designing easier, are condensed into the Colonial Bushing "Flip-a-page" catalog, which is now being mailed.
Circle Inform-A-Gram No. B25.

NEW VIBRATION ABSORBING MACHINE LEVELING Empco JACK

Deadens noise and vibration.
•
Increases machinery life due to reduced vibration.
•
Saves time on installation and maintenance.
•



Tests have proven that "Controlled vibration means increased productivity and decreased maintenance costs." That is why the new Empco Jacks, featuring VI-SORB, the vibration absorbing mounting pads, save many times their initial cost. With the combined features of Empco's self-aligning, two-way control Jacks and VI-SORB pads, set-up and maintenance costs are greatly reduced. For complete data and prices on the new Empco Jack with VI-SORB pads, write or wire today. Immediate delivery.

EMPCO PRODUCTS

THE ENTERPRISE MACHINE PARTS CORPORATION
2735 JEROME AVENUE • DETROIT 12, MICHIGAN

A FRONT LEVER BENCH PUNCH, hand-operated and weighing 70 lbs., is being marketed by T. H. Lewthwaite Machine Co., Inc. Sixty-five sizes of punches and dies for this punch are carried in stock. The company is now mailing new catalog sheets on these products.
Inform-A-Gram No. B26.

LAYOUT AND IDENTIFICATION DYE, for quick identification of bar stock, sheet, strips or parts, is the subject of a circular issued by Michigan Chrome & Chemical Co. A trial sample of this quick-drying dye is also offered.
Inform-A-Gram No. B27.

LOW-COST SHORT RUN STAMPINGS, made with temporary or semi-permanent dies, are the specialty of WLS Stamping Co. of Cleveland. They offer fast delivery of these die cut parts. Full particulars are available.
Inform-A-Gram No. B28.

HAND WHEELS, hand knobs, steel clamping handles and threaded plastic balls are some of the tool specialties described in Reid Tool Supply Co.'s Catalog No. 150. The publication consists of 32 illustrated pages.
Inform-A-Gram No. B29.

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

CHALLENGE LAYOUT SURFACE PLATES provide a perfect surface. Sizes range from 12" x 18" to 54" x 144". All are made of semi-steel. Standard plate thickness is 6". Full data can be found in new Challenge Machinery literature.
Circle Inform-A-Gram No. B30.

WITTEK ROLL FEEDS are made in standard models to meet every requirement in the automatic feeding of strip stock to punch presses or press brakes. A detailed catalog on these feeds is available on request.
Circle Inform-A-Gram No. B31.

PRECISION DIES that produce better stampings, and jigs and fixtures are presented in illustrated literature now being distributed by Harig Mfg. Corp.
Circle Inform-A-Gram No. B32.

THE BELL & HOWELL POCKET COMPARATOR pays for itself quickly by inspecting small parts. National Tool Co., the distributor, is mailing a descriptive folder on this precision optical measuring instrument.
Inform-A-Gram No. B33.

HOTFORM, FOR LIGHT METALS DIE CASTING, is the subject of current Vanadium-Alloys literature. Hotform is available from stock in all die casting die sizes, and in drill rod form.
Inform-A-Gram No. B34.

TOGGLE CLAMP CATALOG. More than 30 pages of descriptions and pictures of De-Sta-Co Toggle Clamps can be found in Detroit Stamp Co.'s latest catalog.
Inform-A-Gram No. B35.

THE BELLOWS MODEL BSM AIR MOTOR is an electrically-controlled power unit with all controls built-in. Specification bulletins and case history files are offered.
Inform-A-Gram No. B36.

SIZE-MARKED SOCKET HEAD CAP SCREWS are easy to sort and save time in assembly. Full details are contained in literature issued by Parker-Kalon Corp.
Inform-A-Gram No. B37.

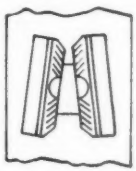
THE STARCO MASTER GRINDING ATTACHMENT is a versatile unit designed to permit grinding of rounds, flats, grooves, etc., in a single setting, using only a surface grinder. Star Gauge Co.'s new catalog shows its universal uses.
Circle Inform-A-Gram No. B38.

THE NEW EMPCO JACK, subject of literature being distributed by The Enterprise Machine Parts Corp., features vibration-absorbing VI-SORB mounting pads, in addition to its leveling ability.
Circle Inform-A-Gram No. B39.

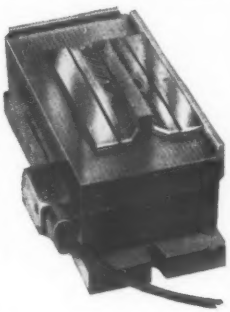
ACME PRECISION DOWEL PINS break before bending or mushrooming—thus saving expensive equipment from ruin through misalignment. An extensive circular is available.
Circle Inform-A-Gram No. B40.

HERE'S HOW YOU CAN HOLD
NON-MAGNETIC MATERIALS ON YOUR CHUCK

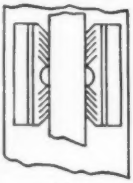
GEARS

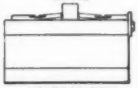

IRREGULAR

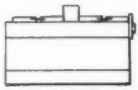
Piece is placed on magnetic surface of chuck between Magna Vise* clamps. When chuck is energized, clamps are drawn down forcibly thus holding piece securely in place on face of chuck.



You can get more use than ever before from your magnetic chucks — *with Magna-Vise!* Holds any rigid non-magnetic material firmly in place — permits you to take full advantage of magnetic chucking for brass, aluminum, copper, fibre, plastics, etc.— cuts set-up time, cuts costs.


BARS


UNCLAMPED POSITION


CLAMPED POSITION

Do you know about the extra holding power of Magna-Lock Chucks? It will pay you to get the facts — today.

Magna-Vise ★ *Patented

Write for full details TODAY—Dept. TJ-100

Hanchett MAGNA-LOCK CORPORATION

Magnetic Chucks and Devices

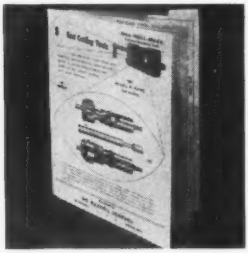
Magna-Lock BIG RAPIDS • MICHIGAN, U. S. A.

SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

SHOP AIDS
For YOU and YOUR JOB

Circle postage-free Inform-A-Gram Key Number for your request.

A NEW TECHNICAL MANUAL ON RECESSING TOOLS for internal forming operations on automatic machines is offered by the Max-



well Co. Designated Manual DB, the publication utilizes photographs, diagrams, sketches and cut-away illustrations to indicate construction features of newly designed recessing tools as well as to show their operating principles. Three sizes of Series "DB" tools are charted for specifications, and their setup procedure is outlined. Write for your copy to THE MAXWELL CO., 225 Broadway, Bedford, Ohio.
Circle Inform-A-Gram No. C1.

THE MATCHED TOOL AND DIE STEEL MANUAL of The Carpenter Steel Co. is now available in a revised edition. This valuable, 189-page guidebook now includes the functional colors that identify the tool steel bars as shipped to customers, in addition to the sections found in the previous edition. Some of these are the tool steel selector section (containing over 80 pages of recommendations), important information on the heat treatment of tool steel and descriptions of the 12 Carpenter matched tool steels. Tool engineers, tool supervisors and others concerned with the making of tools may obtain this comprehensive manual by writing THE CARPENTER STEEL CO., 306 W. Bern St., Reading, Pa.
Circle Inform-A-Gram No. C2.

"HOW TO DETERMINE THE SIZE OF GEARS" is the title of a helpful booklet published by National Erie Corp. This 24-page publication provides a standard procedure in determining the size and horsepower capacities of gears of different materials. This attractively illustrated booklet was prepared by G. E. Katzenmeyer, Consulting Engineer. Send all requests to NATIONAL ERIE CORP., Dept. TDJ, Erie, Pa. Ask for Bulletin No. 3.
Circle Inform-A-Gram No. C3.

ZIP-GRIP SELF-LOCKING SET SCREW DEMONSTRATOR. This giant size model set screw demonstrator clarifies and demonstrates the "contra-thrust" action and the three-way locking principles embodied in the ZIP-GRIP de-

sign. It is constructed of heavy cardboard and includes replicas of a conventional set screw and a ZIP-GRIP. For engineers and other plant executives having vibration problems for which self-locking set screws or adjusting screws may prove the answer, ZIP-GRIP Demonstrators are available on request to SET SCREW & MFG. CO., 158 Main St., Bartlett, Ill.
Circle Inform-A-Gram No. C4.

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

SEND FOR FREE CATALOG TODAY

T-NUT & STUD SETS
STEP BLOCK SETS
PUNCH PRESS SETS

QUARTER TURN SCREWS
SHOULDER SCREWS
DOUBLE END JIG FEET
SCREW TYPE JIG FEET
PRESS TYPE JIG FEET
FLANGED NUTS
CUT THREAD STUDS
TEE-NUTS
COUPLING NUTS
ADJUSTABLE STEP BLOCKS
STAR TYPE HAND KNOBS
HEXAGON TYPE HAND KNOBS
KNURLED HEAD SCREWS

Northwestern
116 HOLLIER AVE., DAYTON 3, OHIO

New NESTING TYPE
TOTE PANS
20" Long x 12" Wide x 6¼" Deep
16 Ga., drag holes, handles both ends.
J. L. LUCAS & SON, INC.
BRIDGEPORT 5, CONN.

REID
SURFACE
GRINDERS
★
THE PRECISION CHOICE OF WORLD-WIDE INDUSTRY
★
1900 50th 1950
Anniversary
REID BROTHERS CO., INC.
BEVERLY • MASSACHUSETTS

RING
PUNCHES
•
HARD—
tough—
concentric

Precision made of Carbon Vanadium Tool Steel. Available in a wide range of stock sizes from 1/32" to 1" point diameters in increments of 1/64". Decimal sizes to order, quick delivery.

Button Dies
Ring type or press fit

Hole tapered to eliminate slug jamming. Sizes in stock to match punch sizes.

Handy data sheet covering specifications and prices sent on request.

Ring Punch & Die Co.
108 Foote Ave., Jamestown, N. Y.

STOCKED FOR DISTRIBUTION BY MOST PRODUCTO DIE SET REPRESENTATIVES

SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

SHOP AIDS

THE "CHICAGO" WHEEL MANUAL, designated Catalog 980-R, is a pocket-sized, 64-page book packed with grinding and mounted wheel recommendations, as well as other useful data. Fully illustrated in two colors, the manual lists sizes and prices of these wheels, together with similar information on other products. These include portable tools, mandrels, brushes and saws. Get your copy by addressing CHICAGO WHEEL & MFG. CO., 1101 W. Monroe St., Chicago 7, Ill.

Circle Inform-A-Gram No. C5.

THE INDUSTRIAL V-BELT CATALOG of Durkee-Atwood Co. contains a wealth of helpful information, including "do's and don'ts" for better transmission efficiency and longer belt life. The 40-page catalog also includes engineering data and drive selections for general duty and multiple V-belts in widths from A through E, complete with calculations, comparison charts and correction factors. DURKEE-ATWOOD CO., Dept. TDJ, Minneapolis 13, Minn., will promptly furnish copies of this catalog upon request.

Circle Inform-A-Gram No. C6.

A PRIMER OF INDUSTRIAL LUBRICATION has been published by the Alemite Div. of Stewart-Warner Corp. Eleven examples of production or machinery expense economies, attained through modern handling and application of greases and oils, are presented in the booklet, with advantages over methods they are designed to improve given in terms of lubricant savings, increased production use of machinery and elimination of labor costs or machine repair costs. Address STEWART-WARNER CORP., 1826 Diversey Pkwy., Chicago 14, Ill.

Circle Inform-A-Gram No. C7.

ACCURACY TO .0001"

FOR TOOL ROOM AND PRODUCTION

FOR AS LITTLE AS **$117.50**

◀ Finishing small wood pattern at 45,000 R. P. M. with the new PRECISE SUPER 40.

IN PRECISE MOUNTS ON LATHES AND OTHER MACHINE TOOLS, PRECISE GRINDER-MILLERS WITH ¼ H.P. AND SPEEDS FROM 20,000 TO 45,000 R.P.M. DO THE WORK OF SINGLE-PURPOSE MACHINES COSTING 100 TIMES AS MUCH!

VERSATILITY. For cylindrical, internal, external and form grinding; for milling with H. S. steel or tungsten carbide midget mills; for micro-finishing and polishing. Use, on wood, glass, rubber, plastics, or any metal including the hardest alloy steel.

DURABILITY. All metal housing, rigid PRECISE quill, lubricant-sealed, micro-precision bearings. ¼ H. P. AC-DC motor (115 volts) is protected by replaceable fusetrons.

ATTACHABLE COOLFLEX SHAFT (optional). Quickly attached for bench work and handtool applications. Same speeds, same precision quill as in PRECISE GRINDER-MILLERS.

▲ PRECISE SUPER 50 grinding die section in Compound Universal Mount on Bridgeport Mill.

Write FOR NEW CATALOG

Precise Products Co., 1341 Clark St., Racine, Wis.

PRECISE GRINDER-MILLERS

"PRACTICAL QUALITY CONTROL" is a collection of TOOL & DIE JOURNAL articles and case histories by outstanding authorities on the subject. This instructive, "how-to-do-it" book contains the following articles: A Complete Quality Control Program; Quality Control of Steering Gear Parts; Quality Control of Automotive Valve Line Production; Demonstrating and Reporting Quality Control; and Shop Talk on Quality Control. Well-illustrated by charts, tables and photographs, this useful volume, No. 5, of the TOOL & DIE JOURNAL Know-How Library, may be obtained for $1.00. Address HUEBNER PUBLICATIONS, 1975 Lee Rd., Cleveland 18, Ohio.

THE 14th EDITION OF "MACHINERY'S HANDBOOK" includes many important changes and added data covering the latest manufacturing practices. It consists of more than 1900 pages covering 136 main subjects or divisions. A special thumb index provides for opening the book instantly to any one of the 14 main divisions most frequently consulted. Price is $7.00. Write THE INDUSTRIAL PRESS, 148 Lafayette St., New York 13, N.Y.

A NEW PORTABLE "AIRFEEDRILL" is the subject of an unusual tool manual just published by Keller Tool Co. Called "The Hole Story of the Keller Airfeedrill," this 24-page booklet contains a word-and-picture history of holes in general, in addition to a description of the new air-driven drill. Write KELLER TOOL CO., 4507 Arbor St., Grand Haven, Mich., for a copy.

Circle Inform-A-Gram No. C8.

REBUILDING WORN SURFACES by metallizing and grinding is described by F. D. Hart, Jr., in a current issue of Norton Co.'s "Grits and Grinds." This informative, technical house organ will be mailed to you monthly upon request. Just address NORTON CO., 1 New Bond St., Worcester 6, Mass.

Circle Inform-A-Gram No. C9.

"FUNDAMENTALS IN THE PRODUCTION AND DESIGN OF CASTINGS," by Clarence T. Marek, is a presentation of the techniques, skills and practices in casting production. Features include an overall view of the casting industry, a description of basic molding processes, the theory of clay bond, a background in the principles of metallurgy and many other important phases of the subject. List price of this book is $4.00. Write to the publisher JOHN WILEY & SONS, INC., 444 Fourth Ave., New York 16, N. Y.

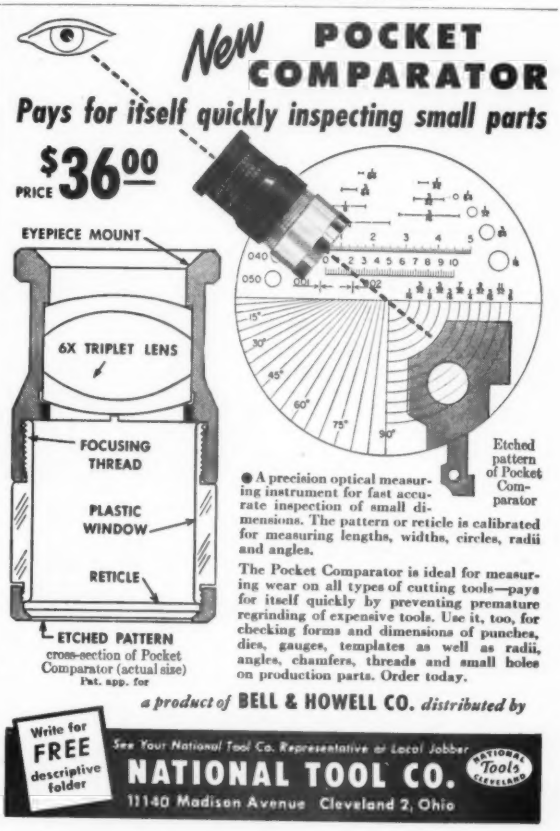
"WELD DESIGN" is a concise volume on welded machine - base design, treating the subject of design from both the practical and theoretical standpoints. Written by Harry D. Churchill and John B. Austin, this 216-page book gives the designer a thorough understanding of the materials that enter into machine-base construction and a clear picture of the many methods of processing plates and structural shapes. Price is $6.65. Write to the publisher, PRENTICE-HALL, INC., 70 Fifth Ave., New York 11, N. Y.

THE MACHINING OF AMPCO METAL is discussed in an interesting new bulletin, No. 66a. It covers the recommended practices for the machining, grinding, honing, polishing, milling, broaching, sawing, drilling, reaming and tapping of all grades of Ampco Metal. Write AMPCO METAL, INC., 1745 S. 38th St., Milwaukee 46, Wis.

Circle Inform-A-Gram No. C10.

A 40-PAGE BOOKLET ON GREASES is available from Shell Oil Co. It explains the scientific principles that make greases a separate category of lubricants and discusses the jobs that grease can do best. An illustrated section shows how greases function in various applications. SHELL OIL CO., 50 W. 50th St., New York 20, N. Y.

Circle Inform-A-Gram No. C11.


New POCKET COMPARATOR
Pays for itself quickly inspecting small parts
PRICE $36.00
EYEPIECE MOUNT
6X TRIPLET LENS
FOCUSING THREAD
PLASTIC WINDOW
RETICLE
ETCHED PATTERN
cross-section of Pocket Comparator (actual size)
Pat. app. for
Etched pattern of Pocket Comparator
● A precision optical measuring instrument for fast accurate inspection of small dimensions. The pattern or reticle is calibrated for measuring lengths, widths, circles, radii and angles.
The Pocket Comparator is ideal for measuring wear on all types of cutting tools—pays for itself quickly by preventing premature regrinding of expensive tools. Use it, too, for checking forms and dimensions of punches, dies, gauges, templates as well as radii, angles, chamfers, threads and small holes on production parts. Order today.
a product of BELL & HOWELL CO. distributed by
Write for FREE descriptive folder
See Your National Tool Co. Representative or Local Jobber
NATIONAL TOOL CO.
11140 Madison Avenue Cleveland 2, Ohio
National Tools Cleveland

SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

Humidity Control Insures Wheel Quality

Grinding wheels, like humans, are extremely susceptible to changes in humidity, according to results of recent moisture tests conducted by Chicago Wheel & Mfg. Co. to show the importance of their new cut-off wheel packaging.

Cut-off wheels are critically affected by exposure to moisture. The bonding post holding the abrasive particles to the wheel loosens its hold on the abrasive as moisture goes to work on it. Hence, the effective operation of the wheel itself, as well as the length of its working life, is seriously hampered by this dampening condition.

Instead of the ordinary kraft paper used by many manufacturers, Chicago Wheel packages their wheels in a glassine, heat-sealed envelope.

Two sample cut-off wheels were used in the tests, one a coarse grade and the other a fine grade. They were broken into pieces 2" square and then oven dried for two hours at 100° C. Half of these

pieces were enclosed in small glassine envelopes, which were then placed in atmospheres of high relative humidity, together with the uncovered samples.

Differences in weight were checked periodically during these tests. In a 50% humidity atmosphere, the samples were allowed to remain for two weeks. The moisture pick-up for the coarse grade samples was decreased 29% and the fine samples 17%, through use of the heat-sealed, glassine container.

Complete details may be had from CHICAGO WHEEL & MFG. CO., 1101 W. Monroe St., Chicago, Ill.
Circle Inform-A-Gram No. D2.

NEW
TWIN PRODUCTS
DOWEL PINS
DRILL RODS

JUST ARRIVED AT...
MARSHALL STEEL CO.
Companion Items to Ground Flat Stock

Now available in the finest high-grade steel, produced with the same precision-ground quality that has always passed extremely rigid inspection.

QUICK SERVICE on Specials up to 2½" in Diameter.

WRITE FOR NEW CATALOG AND PRICES
LARGEST RANGE OF SIZES IN VELVET-FINISH, PRECISION GROUND FLAT STOCK, THREE KINDS: WATERcrut, OILcrut and AIRcrut.

MARSHALL STEEL CO. Box 108, A LA GRANGE, ILLINOIS

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

Perkins No. 201-S back geared Press

7" stroke-distance, bed to ways, 21"
1 h.p. back gear motor drive

Designed particularly to fill the need for a long stroke press with ample die space for unusual requirements.

Production men will readily recognize the opportunity presented in this Perkins *specialized* Press. Faster, easier die setting means extra production, more profitable operation.

Perkins press parts are easily, quickly replaced when worn, no lost down time. Bulletin on request.

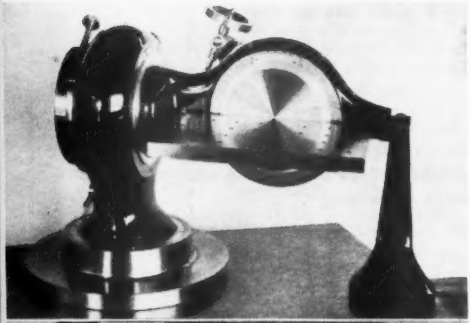
PERKINS MACHINE COMPANY
WARREN, MASSACHUSETTS
Press builders for 50 years
Presses built to special specifications

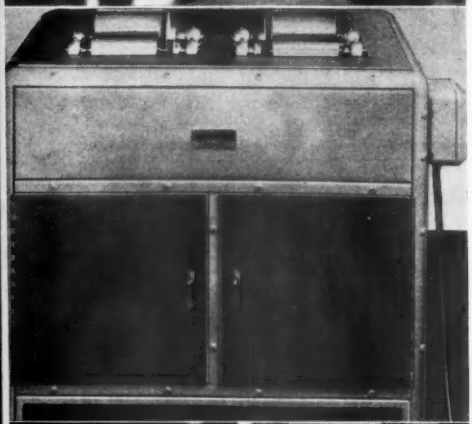
ALL THE DATA YOU NEED...
...at the flip of a single page
Make drill jig designing easier with this "Flip-a-page" catalog.
Free on Request
COLONIAL BUSHINGS INC.
P.O. BOX 37, HARPER STATION
DETROIT 13, MICHIGAN

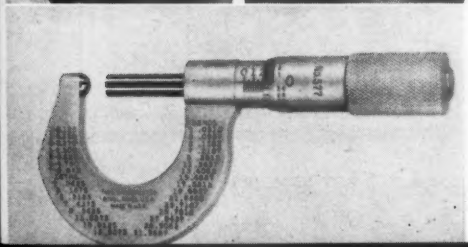
SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

PROGRESS

NEW DEVELOPMENTS • IMPROVEMENTS • COST AND TIME SAVERS







CIRCLE KEY NUMBERS ON POSTAGE-FREE INFORM-A-GRAM INSERT FOR FURTHER INFORMATION

THE STUDLER ANGLE COMPUTER. Model "G," shown at the left, incorporate three axes of rotation: the horizontal, the vertical, the radial. All protractors are graduated from 0 to 90° in four sections of the circle, and one-minute verniers are standard equipment. The surface plate measures 9" x 16". A detachable support is provided for use when checking or laying out castings or other parts weighing in excess of 75 lbs. Write THE ANGLE COMPUTER CO., 1709 Standard Ave., Glendale 1, Calif.

Circle Inform-A-Gram No. A1.

CENTERLESS LAPPING MACHINES are made by Size Control Co. in two models. Pictured is Model 200, complete with two sets of rolls for finishing and roughing. It obtains a finish of down to 1½ micro-inches and removes approximately .00005" with each pass. Also made by the company are Rev-Ag Handles, developed to enable customers to use their surplus AGD NO-GO members and at the same time obtain the advantages of reversible GO members. Address THE SIZE CONTROL CO., 2500 Washington Blvd., Chicago 12, Ill.

Circle Inform-A-Gram No. A2.

THE NORTON CERAMIC SURFACE PLATE is a stable, non-deflective, non-corrosive, non-magnetic lightweight surface plate that can be easily moved from job to job if desired. A precisely flat surface guaranteed to be within .0001" is afforded, together with a continuously smooth surface finish and extreme wear-resistance. Two applications are shown. Write for full particulars to NORTON CO., 1 New Bond St., Worcester 6, Mass.

Circle Inform-A-Gram No. A3.

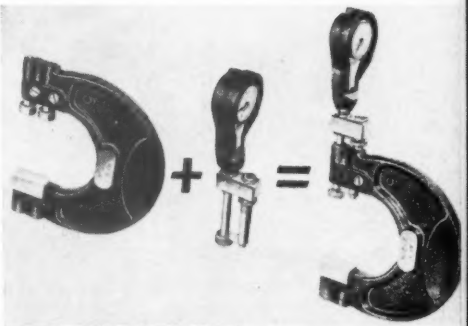
A NEW MICROMETER WITH ROUNDED ANVIL, Starrett's No. 577, makes it possible to measure in thousandths of an inch the wall thickness of tubing, half bearings and full bearings, and various cylinders with walls up to 1" thick and diameters down to ⅜" inside diameter. The full finished frame as well as the thimble and sleeve have rust-resistant, no-glare Satin Chrome Finish which makes markings stand out sharp, clear and easy to read. THE L. S. STARRETT CO., 121 Crescent St., Athol, Mass., will provide complete information.

Circle Inform-A-Gram No. A4.

ON PARADE

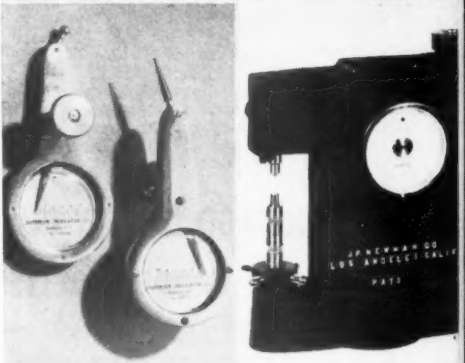
THE DIALIZER, for converting a regular AGD adjustable limit snap gage to a dial snap gage, is being made by Standard Gage Co., Inc., for frames No. 1 through No. 6. The Dializer is inserted in place of two gaging pins of AGD adjustable limit snap gages. Thus a limit gage can be changed to a dial gage giving quantitative readings at low cost. After the Dializer is installed, it is easily adjusted by means of a knurled nut. It may be clamped in final position by the same locking mechanism used originally for one of the gaging pins. STANDARD GAGE CO., INC., Dept. TDJ, Poughkeepsie, N. Y.

Circle Inform-A-Gram No. A5.



THE NEW DIAL INDICATOR shown in the inside cut is a conversion to a dial indicator from the open-end style. It has a double face and can be read simultaneously front and back. A new feature of this chrome-plated, rust-proof instrument is its twin-telescoped contacts. The stem part of the stationary 1/32" contact is threaded with 1/32" ball formed on end. This being smaller, it is screwed within a ⅛" contact which can be put on or off instantaneously. This eliminates the necessity of having two indicators—one with a large contact and one with a small contact. SUPERIOR INDICATOR CO., P. O. Box 734, Rochester 3, N. Y.

Circle Inform-A-Gram No. A6.



A PORTABLE HARDNESS TESTER (outside cut) with a three-inch capacity is now being marketed by J. P. Newman Co. The large opening is suitable for 95% of all shop and laboratory work. The over-all size is 9" x 11" with a 3½" base; weight is 6½ lbs. without case. This tester is a high-grade instrument of the Rockwell type of measurement, covering C, B and E scales; all other scales are covered by a transposing chart. Write J. P. NEWMAN CO., 3544 E. Fowler St., Los Angeles 33, Calif.

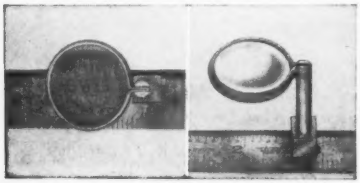
Circle Inform-A-Gram No. A7.

THE FLASH-O-LENS ILLUMINATED MAGNIFIER has been improved by E. W. Pike & Co. It has a knurled pinion for adjusting the 20 or 40 power tube easily and accurately to the user's exact visual needs. A rubber roller on the shaft of the pinion, which is mounted on the instrument housing, bears against the vertical tube, housing the lenses. By turning the knurled pinion, the tube and lenses can be raised or lowered to bring the object being examined into perfect, sharp focus. E. W. PIKE & CO., 492 North Ave., Elizabeth 3, N. J.

Circle Inform-A-Gram No. A8.

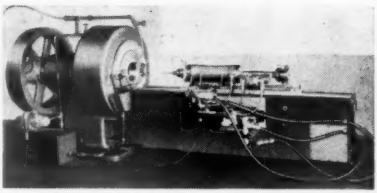
PROGRESS ON PARADE

THE MAGNET MOUNTED MAGNIFIER consists of a powerful magnifying glass mounted on a supporting post to which is attached a high-strength Alnico magnet. Intended for reading fine scales, the magnifier is held by

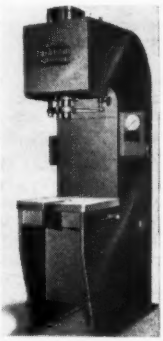


the magnet firmly attached to any steel or iron surface, leaving both hands free. THE MILLER CO., Dept. TDJ, Waseca 12, Minn.
Circle Inform-A-Gram No. A9.

A SWAGING MACHINE that features newly developed special dies, and that successfully swages harder and tougher steels in length-to-diameter ratios above previous standards, is being marketed by Fenn Mfg. Co. Developed for a textile machine manufacturer to produce tapered spindles, the machine is also adaptable to a wide range of other uses. With this swager, material requirements for the spindles were cut in half. Three cycles are used to produce the spindles. Detailed information is obtainable from FENN MFG. CO., 1841 Broad St., Hartford 1, Conn.
Circle Inform-A-Gram No. A10.



A NEW 10-TON HYDRAULIC FORCING PRESS, Model F-101, is offered by Hannifin Corp. It is floor mounted, with an 18" x 20" table 36" above the floor. Standard models have a 3-inch "U"-slot in the table. Gap is 22", reach is 10" and maximum stroke is 12". The press is completely self-contained, with a 5 hp vertical motor and an 11 gpm constant volume pump. Write HANNIFIN CORP., 1163 S. Kilbourn Ave., Chicago 24, Ill.
Inform-A-Gram No. A11.



CHICAGO "SAFETY PLUS" SOCKET SCREWS MAKE YOUR PRODUCT BETTER 4 WAYS

• **THEY'RE STRONGER**—They fasten products MORE securely—give a sturdier, tighter "hold".
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• **MORE ACCURATE**—They're consistently more accurate in dimensions, have sharper, smoother, truer threads, start in easier the first time.
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There is a Chicago "Safety Plus" Product designed to give you a tighter, lower cost fastening for ANY heavy duty purpose.
FIND THE TYPE YOU NEED FROM THIS LIST:

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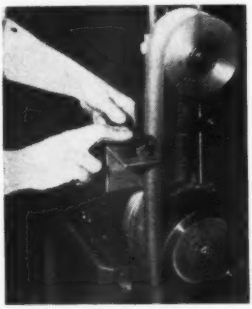
The CHICAGO SCREW COMPANY
2519 WASHINGTON BLVD., BELLWOOD, ILL. • *Established 1872*

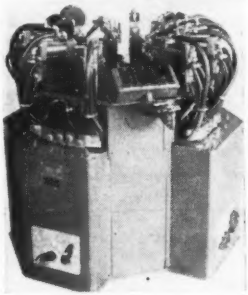
THE XPEDITOR ABRASIVE BELT GRINDER has been designed to cut costs on many secondary and clean-up operations in the various departments of metalworking and other plants. With this unit at the sides of milling machine



operators, they can deburr, remove cutter marks, break corners, etc. It can be set alongside of band or hacksaws and used to clean up tool marks, round out contours and deburr. Literature containing full particulars may be obtained by writing H. L. RAMSAY CO., 636 S. 10th Ave., La Grange, Ill.

Circle Inform-A-Gram No. A12.

THE SCIAKY MG-5 WELDER, for welding household mixer-base units, is basically a table-top welder with 10 adjustable, self-centering welding guns and five series welding transformers rated 35 KVA at 50% Duty Cycle. This machine can weld better than



520 units per hour as compared with 125 units formerly produced on a foot-operated welder. No buffing or grinding is necessary on the completed parts. An electronic control cabinet (not shown) is mounted separately and has a control sequence of Squeeze-Weld-Hold-and-Off Times. Write SCIAKY BROS., INC., 4915 W. 67th St., Chicago 38, Ill.

Circle Inform-A-Gram No. A13.

NOW!

A SELF-ALIGNING, SELF-ADJUSTING LAP

Announcing

THE IDEAL "XPAND-O-LAP"

(Patented, No. 2,434,000)

FASTER — MORE ACCURATE REQUIRES NO ADJUSTMENT

No set screws — nothing to break — only 4 parts — arbor, two copper sleeves & S-shaped pressure spring.

Accurate because self-expanding pressure principle maintains concentricity and alignment, even when sleeves become worn. Faster because maximum area of shoe contacts work at all times. Specially tempered S-shaped spring applies constant, self-adjusting pressure against sleeves. Never galls or seizes. Worn sleeves can be replaced in a jiffy! Complete sets of 6 (in stand): one each 1/8", 3/16", 1/4", 5/16", 3/8" and 1/2".

SOLD THROUGH LEADING DISTRIBUTORS

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4151 Park Avenue, Sycamore, Illinois

Please forward catalog information on "XPAND-O-LAP" and other items as checked:

☐ Live Centers ☐ Etchers ☐ Tachometers
☐ Demagnetizers ☐ Dust Collector

Name_____

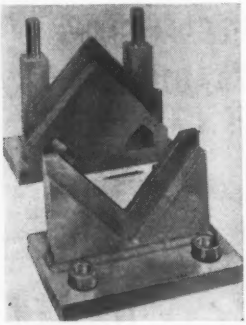
Company_____

Address_____

City_____ Zone____ State____

PROGRESS ON PARADE

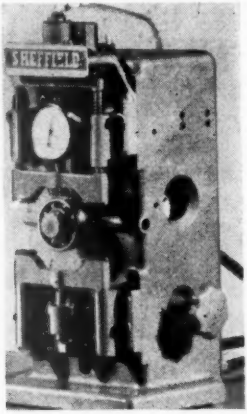
DIE SET SERVICE. The welding and finish-machining required to complete these DIE-CO special die sets ready for the tool steel, are produced by new service facilities of The Die Supply Co. Buyers of the sets can order



this time-consuming work to be included. Write to DIE SUPPLY CO., 5349 St. Clair Ave., Cleveland 14, Ohio.

Circle Inform-A-Gram No. A14.

RADIAL INTERNAL CLEARANCE of ball and roller bearings now can be accurately measured on a production basis by a new Sheffield instrument. The balls are positively positioned at the bottom of the grooves with



the races in proper relations to each other during measurement. THE SHEFFIELD CORP., 721 Springfield St., Dayton 1, Ohio.

Circle Inform-A-Gram No. A15.

FRONT LEVER BENCH PUNCH

Hand Operated

Weight 70 pounds

Capacity: 7/16" hole through 1/4" steel or equal.

65 sizes of punches and dies for this punch are carried in stock for immediate shipment in round, flat, oval and square sizes.

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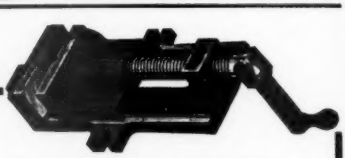
T. H. LEWTHWAITE MACHINE CO., INC.
314 East 47th St. New York 17, N. Y.



YOST DRILL PRESS VISE

● **This new Yost vise has been designed expressly for use on drill press operations. Does away with special and costly jig fixtures.**

OFFERED IN TWO SIZES

Vise No.	Width of Jaw, Inches	Opens Inches	Weight Pounds
1D	3½	4	12½
2D	5	5½	23

Do you need a vise of ANY type?

Write today for bulletin on the extensive Yost line

YOST MFG. COMPANY
1000 MAIN STREET
MEADVILLE • PENNSYLVANIA

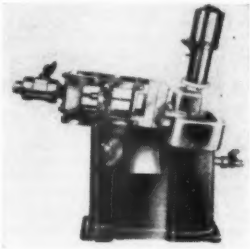
PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

AUTOMATIC FRICTION ROLL FEEDS. Four models now comprise this expanded Benchmaster line. The new models will handle stock in widths of 3", 5", 7" and 9", respectively,

with an adjustable stroke that can be varied from 0" to 3". Maximum thickness capacity is 3/16". While designed for Benchmaster presses, these feeds are readily adaptable to fit virtually all makes of presses. They are equipped with an angle bracket that mounts to the press bed or bolster plate, permitting vertical adjustment to align rolls with the die. Complete information may be had from BENCHMASTER MFG. CO., 2952 W. Pico Blvd., Los Angeles 6, Calif.

Circle Inform-A-Gram No. A16.

A NEW DCMT DIE CASTING MACHINE. Model A16A, features automatic injection of molten metal and automatic opening and closing. This completely air operated machine has been designed to enable manufacturers to do their own die casting of small parts in their own shops. The machine now

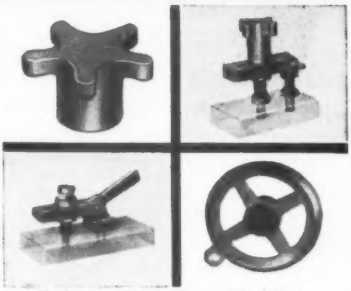


takes jobs up to 1 lb. capacity. DCMT DIE CASTING MACHINE CORP., 164 Duane St., New York 13, N. Y.

Circle Inform-A-Gram No. A17.

QUICKER SERVICE ...FINEST QUALITY

THAT'S WHY YOU "GET MORE WITH MORTON"



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FIXTURE CLAMPS
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Fixture Details

SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

PROGRESS ON PARADE

THE NEW FOREST CITY RADIUS TOOL is designed for use on lathes, shapers, planers and screw machines in cutting a standard range of fillets, grooves, hubs, round corners or shoulders. In most operations it eliminates individual hand grinding and checking of tools. A set of replaceable circular form tools is supplied with each tool holder. Write FOREST CITY BIT & TOOL CO., 1224 Kishwaukee St., Rockford, Ill.

Inform-A-Gram No. A19.

FAST COUNTERSINKING, CHAMFERING AND BURRING can be done on a new machine made by Black Drill Co. It consists of a cast iron base on which are mounted two traversing shaft motors with opposed cutting tools mounted in collets a the ends of the shafts, plus a tool post and work-holder located at the center of the assembly. The tools are brought to the work by depressing a foot pedal. BLACK DRILL CO., 1368 E. 222nd St., Cleveland 17, Ohio.

Circle Inform-A-Gram No. A20.

A DRILL PRESS FEED in two models is announced by Modernair Corp. The single-acting power unit, installed on the spindle of a drill press,, permits controlled power operation. Due to a unique self-aligning feature, the annular piston moves inside a fully enclosed annular cylinder, so that the unit floats on drill spindle directly over drill point. MODERNAIR CORP., 4222 Hollis St., Oakland 8, Calif.

Inform-A-Gram No. A21.

Precision Die Made—Lowest Possible Cost.

DAYTON ROGERS MFG. CO., Minneapolis 7, Minn.

BLUE LAYOUT DOPE

Speeds layout on all metals. Dries fast. Oil resistant. Won't chip, crack or flake off. Comes in handy 8-oz. brush-in cans, pts., qts., drums. Order now! SAMPLE FREE!

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UNEEDA LIGHT directs a beam of white light on your close precision work . . . .

Tool and Die Makers acclaim it for its utility, getting into nooks or crevices hard to get at with ordinary light—for lining up punches in dies, or working with the scriber in close places. Completely adjustable and portable. Light does not reflect back to your face. Ideal for Inspectors seeking burrs, flaws, etc. Price—complete with 2 size bulbs, $12.50.

Write for literature

Twentieth Century Mfg. Co.
3720 Montrose Ave. Chicago 18, Ill.

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

ONE ELK UNIVERSAL PRECISION TOOL HOLDER can perform the work of 10 single-purpose tool holders, with a maximum of convenience and flexibility. Some of its features are the following: simplifies and speeds up machining operations; bit can be removed for regrinding in any operation without disturbing the setting of the tool holder in the tool post; precision made for smoother operation

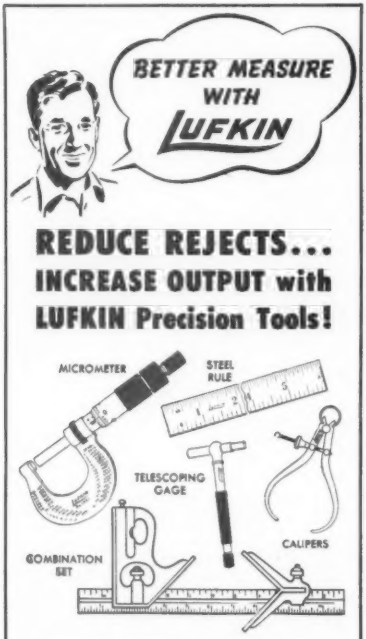
of locking device, which holds bit secure—eliminates chatter and bit breakage; can be locked in either right- or left-hand position; and is ideal for use with carbide tools. Round boring bars and threading tools can be used in the same holder. Address ACME TOOL CO., 71 W. Broadway, New York 7, N. Y.

Circle Inform-A-Gram No. A22.

DIEMAKERS AMPCO BUSHINGS. New branded AMPCO Metal Guide Post Bushings, which can be fitted closely to provide maxi-

mum supporting alignment for costly punches and dies, are announced. These bushings will not gall or cause sheared or broken die members, score, seize or rust. They are made from centrifugally cast bar stock and will outlast steel or ordinary bronze bushings. A catalog showing sizes is obtainable fom DIEMAKERS SUPPLIES, INC., Dept. 48, 2779 E. Grand Blvd., Detroit 11, Mich.

Circle Inform-A-Gram No. A23.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REDUCE REJECTS...
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Accurate, quality-control measuring with Lufkin superior precision tools can slash your reject rate . . . increase your output . . . up your profits! Every single Lufkin tool, several of which are illustrated above, is well designed, sturdily constructed, carefully finished, critically inspected. First with scores of improvements and features, Lufkin precision tools find favor with mechanics everywhere. When you need Precision—Buy Lufkin. For complete details, write for a copy of Lufkin Precision Tool Catalog #7.
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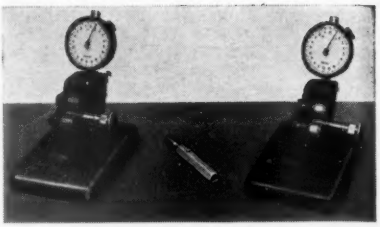
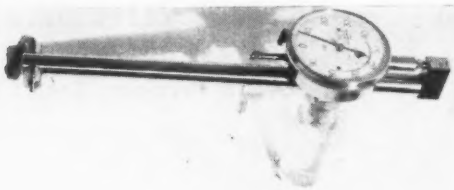
SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

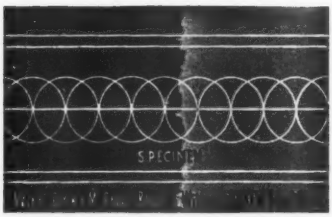
PROGRESS ON PARADE

THE NEW TRI-ROLL THREAD COMPARATOR produced by Pratt & Whitney makes possible rapid and accurate checking of male threads. Externally threaded parts to be measured are cradled between two stationary gaging rolls and a third roll, mounted on a preloaded armature, is swung into contact. A dial indicator graduated in increments of .00025" gives cumulative readings of errors in lead, angle and pitch diameter. Gaging rolls are form ground in a series of annular ribs. Where a check on pitch diameter only is desired, rolls with only two ribs are used. Further data may be had from PRATT & WHITNEY, Div. Niles-Bement-Pond Co., 15 Charter Oak Blvd., West Hartford 1, Conn. **Circle Inform-A-Gram No. A24.**





RIMAT DIAL BORE GAGES, especialy designed to measure diameters of "0" ring grooves, snap ring grooves, etc., are now available with interchangeable indicator mountings. This standardization makes it practical to use one dial indicator on any one of several gages. Write RIMAT MACHINE TOOL CO., 1121 Airway, Glendale 1, Calif. **Inform-A-Gram No. A25.**



DYKEM STEEL BLUE
STOPS LOSSES
making dies and templates

Simply brush on; ready for the layout in a few minutes. The dark blue background makes the layout lines show up in sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

Write for full information.

THE DYKEM COMPANY
2303L North 11th Street • St. Louis, Mo.

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CONSULTING AND DESIGNING ENGINEERS
- **METAL WORKING PRESSES**
- **SPECIAL MACHINERY**

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MODEL JA
50,000 R. P. M.
Weight 12 ounces; length 6¾ inches; chuck size ⅛ inch. Wheel guard removed for better illustration.

$42
IN U.S.A.

THEY GRIND—NOT JUST RUB!

The RPM's stay up while grinding . . . not only when the grinder runs idle.

It is an established fact that surface speeds must stay up to approximately a mile a minute if you want to grind . . . not just rub. Every mechanic knows this, but an inexperienced buyer may order tools that maintain proper grinding speeds only when running idle. The speed of Kipp air grinders drops but slightly when put to work. That means better work . . . longer wheel life.

MADISON-KIPP CORP.
212 Waubesa St. • Madison, Wis., U. S. A.

PROMPT SPEEDY DELIVERY OF UNIVERSAL DRILL BUSHINGS

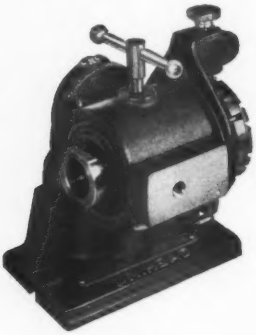
You will receive prompt speedy delivery of any size Universal Drill Bushings to any point in the United States — orders for standard size bushings will be filled and shipped within 24 hours—because our warehouses are so located and stocked as to give excellent service without delay. Order by teletype, phone, wire or letter from your nearest Universal warehouse at 1060 Broad Street, Newark, N. J.; 5035 6th Avenue, Kenosha, Wisc., or Frankenmuth, Mich.

UNIVERSAL ENGINEERING COMPANY
FRANKENMUTH 8, MICHIGAN

SEE ADVERTISERS INDEX, PAGE 119, FOR KEY NUMBERS

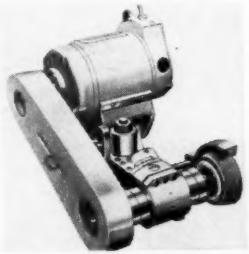
PROGRESS ON PARADE

A UNIVERSALLY ADJUSTABLE WORK HEAD that provides greater flexibility in grinding spiral mills, end mills, keyway cutters, saw blades, etc., has been developed by Delta. Known as the Unihead, this work head consists of a heat-treated sleeve arranged with a No. 9 Brown & Sharpe taper and accurately mounted in pre-loaded, sealed, lubri-



cated-for-life ball bearings. DELTA POWER TOOL DIV., ROCKWELL MFG. CO., 600 E. Vienna Ave.,, Milwaukee 1, Wis.
Circle Inform-A-Gram No. A28.

THREAD GRINDING, in addition to internal, external and surface grinding, can be

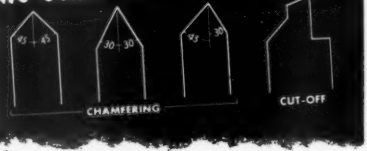


done with the T500 Tool Post and Thread Grinder introduced by K. O. Lee Co. The T500 uses a T-slot mount and will adapt most standard machine tools for precision grinding operations with accuracy to tolerances as close as .0001". A ⅝ hp, universal type ac-dc motor is standard for 115 or 230 volts. K. O. LEE CO. 1150 First Ave., S.E., Aberdeen, S. Dakota.
Circle Inform-A-Gram No. A29.

WHEN ACCURACY COUNTS...
Contact SCHERR!
TOOLMAKERS MICROSCOPE

FOR COORDINATE MEASUREMENT 4"x 2" AND PROTRACTOR OCULAR IN MINUTES • TEMPLETS FOR ALL STANDARD THREADS •
Smaller and Larger Sizes suitable for all shop requirements available
WRITE FOR ILLUSTRATED FOLDER
GEORGE SCHERR CO., INC.
COMPLETE LINE OF PRECISION INSTRUMENTS
200-T LaFayette St. New York 12, N.Y.

No Other Tools Like These!



Because they are made from a special Tungsten type high speed steel by skilled tool makers and they are Mastercased.

No operator can get more out of a tool than its maker puts into it. Tri-Jay Masterform tools are designed and built to outperform all other tools, not undersell them. They need no outside help to produce more finished parts.

All you can buy in any tool is life performance. Therefore, it would seem logical to buy tools as you do tires — on a mileage basis.

Write for Bulletin #450.

TRI-JAY MASTERFORM TOOL CORP.
6316 Northwest Highway, Chicago 31

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What is a HOPPER?

In This Case, It's Not a Storage Bin . . .

THE D. P. S. HOPPER UNIT

is a SELECTIVE FEEDING DEVICE whereby production parts are selected, oriented and fed in a given position for primary and secondary operations.

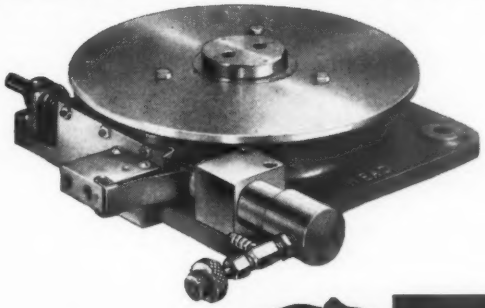
It is the result of years of experience in solving feeding and assembling problems, speeding production, reducing costs and eliminating the manual handling of parts. D.P.S. Hopper Units are widely adaptable to Presses, Centerless Grinders, Thread Rolling and Slotting Machines and special machines. They do a precision job of feeding screws, screw blanks, rivets, pins, nuts, discs, washers, steel balls, etc. Sizes 8", 10", 12", 16", 24" and 30" diameters. Let D.P.S. Hoppers prove their indispensability in your plant.

Send for Catalog and further details

DETROIT POWER SCREWDRIVER CO. 2827 W. FORT ST. DETROIT 16, MICH.

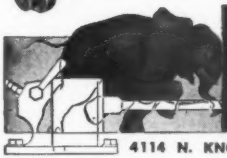
Air Operated

ROTARY WORK FEEDER



Deftly holds and delivers small parts to drill, tap, swage, stake, etc. Stations accurate to .002". Guaranteed against over-travel or "skipping". Indexes as slow or fast as you like, up to 10,000 per hour. Compact and sturdy, easy to tool and hook up. Standard dial plate 10"; available in 12". For a new job, simply tool up a new dial. Readily combines with "MEAD-MATIC" Timer, Air Hammer, Air Press, Drill presses, etc.—to make almost completely automatic machine—operator merely loads.

Write for full details.

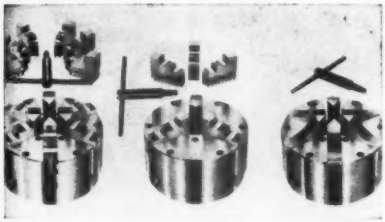


MEAD
SPECIALTIES COMPANY

4114 N. KNOX AVE., DEPT. HA-100, CHICAGO 41, ILL.

PROGRESS ON PARADE

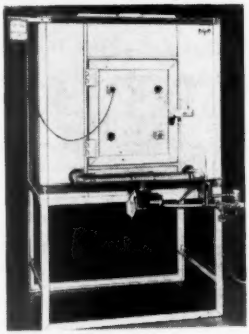
THE "AJUST-TRU" CHUCK of Buck Tool Co. is a new self-centering chuck with a built-in adjustment for .0005" accuracy. Precision-ground on all working surfaces and production balanced, the "Ajust-Tru" chuck



provides the flexibility and speed of scroll chucks plus the precision of 4-jaw independent chucks. The jaws, either three or six, go in or out to grip the work like any scroll chuck. Precise adjustment is made by four opposed fine-threaded screws operating between the chuck body and its adapter. Inquiries should be directed to BUCK TOOL CO., 1918 Schippers Lane, Kalamazoo, Mich.

Circle Inform-A-Gram No. A32.

A PRECISION FURNACE for the heat-treating of metals is now being made by A. D. Alpine, Inc. It is available in capacities ranging from 1.8 cu. ft. to 20 cu. ft. and has a range of from 0° to 2500° F. Alpine furnaces are equipped with porcelain protected thermocouples and direct-reading pyrometers with calibrated energy input and atmosphere proportioning. Economy of operation is effected by means of a patented forced draft type of burner that will operate successfully on natural, manufactured or liquid petroleum gases.



Further data may be had from A. D. ALPINE, INC., Dept. 250, 11837 Teale St., Culver City, Calif.

Circle Inform-A-Gram No. A33.

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CAM MILLING

A SPECIALIZED ROWBOTTOM CAM MILLING SERVICE... JIG BORING... SPOT WELDING... CONTRACT PRODUCTION ... EXPERIMENTAL DEVELOPMENT

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Want the best?

Specify ACE DRILL BUSHINGS

- 3/4 MILLION BUSHINGS IN STOCK is your assurance of prompt service
- WEST COAST AERO TOOL'S REPUTATION is your guarantee of highest quality
- HIGHEST QUALITY TOOL AND ALLOY STEELS provides extreme durability and longer life
- PRECISION MADE — LIGHT-WAVE TESTED for .0003 maximum tolerance

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ACE DRILL BUSHING CO.
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THESE HANDNIBS LEAD IN POPULARITY

These indispensable handymen of the shop shear and nibble (outside and inside) up to 1/16" flat stock; openings for cutting 3/16", 1/4", 5/16", 3/8" rods. No. 5 also punches up to 1/2" holes in 1/4" stock. No. 4 available for bench or vise mounting; No. 5 standard or swivel bench mounted. Write for full details or ask your dealer for a demonstration.

NATIONAL MACHINE TOOL CO.
DEPT. 130-K RACINE, WISCONSIN

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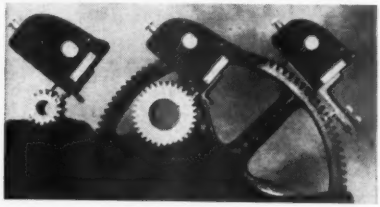
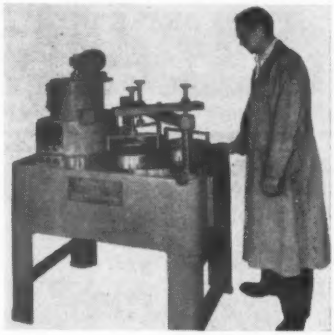
GEARMASTERS. With Gearmaster instruments, several measurements of gear characteristics can be made in one operation and to



a high degree of precision. Instrument bodies of Invar nickel steel insure freedom from errors due to expansion or contraction in the temperature range to which such tools are subjected. Combined with sight reading charts for spur gears, Gearmasters give, in one setup, chordal measurement, tooth thickness, tooth spacing, pressure angle, tooth form or involute, backlash allowance, pitch-diameter and mandrel run-out. Write URBAUER ENGINEERING CO., Dept. TDJ, Naperville, Ill., for details.

Circle Inform-AGram No. A34.

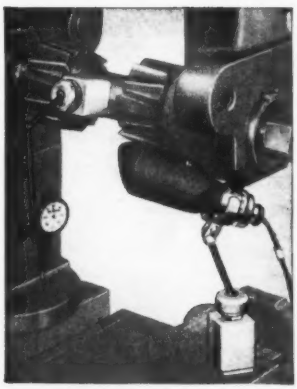
PRECISION LAPPING MACHINE. Known as the "Lapmaster," this machine generates quality surfaces to flatness measurements of one light band or less (11.6 millionths of an inch), and finishes to 1 to 3 RMS—in high production quantities. Simplicity of design allows ease of loading and unloading. Other sizes are the 12, 36, 48 and 72. The size numbers refer to the lap diameter of the plates. A



special 16-page booklet offered by the manufacturer describes the entire line. Write to CRANE PACKING CO., Dept. H-13, 1800 Cuyler Ave., Chicago 13, Ill.

Circle Inform-A-Gram No. A35.

NEW MAGNETIC HOLDER ELIMINATES CLAMPS



Simply place the Miti-Mite magnetic holder against any round or flat iron or steel surface. Holds test indicators or 40 watt Handi-Lite lamp described below. No clamps needed. Saves mechanic's time trying to find suitable place to clamp. Powerful Alnico magnet exerts 50 lb. pull. Ball and socket and swivel arm construction gives versatile adjustment. Indicator Holder has 7/32" dia. stem, which handles most indicators.

PIN-POINT LIGHTING— The Miti-Mite Handi-Lite with magnetic base, is ideal for dark, hard to get at corners, and precise jobs requiring pin-point lighting. Special 40 watt bulb throws concentrated beam of light. Adjustable shield throws light on work without glare in operator's eyes. Outside of shield has special rayon coating to prevent heat from being transmitted from bulb to shield. Equipped with oil resistant plastic cord.

Model 100 Indicator Holder in wood box.....$ 6.50

Model 200 Handi-Lite in wood box..... 7.50

Model 300 Combination of both in wood box..... 13.50

Order from your mill supply dealer or send order with name of your mill supply dealer. Ask for Bulletin No. 600.

Also mfrs. of Enco Hexturrets, Turret Tool Posts and Tailstock Turrets

ENCO MANUFACTURING COMPANY DEPT. 7100 4522 W. FULLERTON AVE. CHICAGO 39, ILLINOIS

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P. O. Box 122, Englewood, Ohio—10 miles north of Dayton, Ohio. Rt. No. 48 and 40.
All types of tools and dies including Molding and Sectional Ground Dies, Precision Production Parts, Stampings.

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COUNTERBORES and drills...

IN STANDARD SIZES AND OVERSIZES ABOVE STANDARD DIMENSIONS

▼ SUPERBORE Counterbores provide that shade of difference when counterboring operations require oversizes from standard dimension holes. Precision grinding inside of flutes and pilots after heat treating, allow chips to flow out freely. The flutes are backed off to width of land to prevent heat generation, clogging or freezing. Each set is serial numbered. No. 500 consists of ten standard dimensions, counterbores and drills. No. 400 is 1/64" oversize and No. 300 is 1/32" oversize above standard dimensions. ORDER YOURS TODAY!

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DIE CUT PARTS

Low Cost Short Run Stampings Using Temporary or Semi-Permanent Dies.
Fast Delivery. Write for Quotes.

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Your business letterhead will bring literature.

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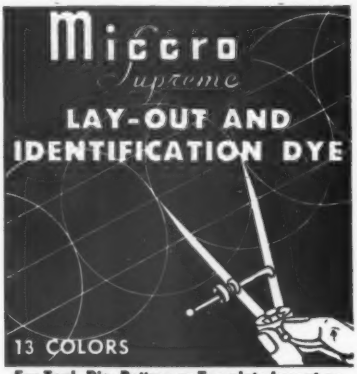
LAY-OUT AND IDENTIFICATION DYE



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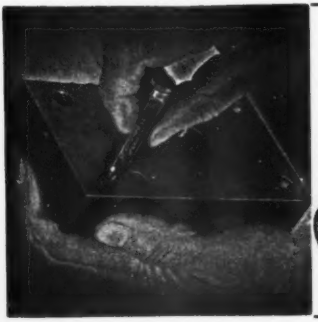

A REAL HELPING HAND

It's a help that die makers, tool makers, machinery builders and general machinists have long sought—a more accurate and surprisingly faster way of transferring screw holes.

The Heimann Transfer Screw Set is a self-contained, complete tool. No wrenches or pliers are necessary. Made in 3/16" to 1" diameters.

Send for price list.

HEIMANN MFG. CO.
Dept. T
Urbana, Ohio

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Hammond WET or DRY

CARBIDE TOOL GRINDERS

HAMMOND Carbide Tool Grinders will soon pay for themselves through greater wheel economy, longer tool life and faster grinding.

AMERICA'S MOST COMPLETE LINE.

6", 7", 10", 14" Wet or Dry—also Chip Breaker and Diamond Finishing Grinders.

WRITE FOR CATALOG 220

Model WD-10 Wet or Dry 10" Carbide Tool Grinder.

Hammond Machinery Builders INC

1631 DOUGLAS AVENUE KALAMAZOO, MICHIGAN

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Because R-B* Punches and Dies are INTERCHANGEABLE

Here's part of a die holding ten R-B punches, any one of which will interchange with the other, or with any other R-B punch of like size . . . mating perfectly with the corresponding die.

This R-B interchangeability saves on die-making and operation because it: (1) reduces punch and die inventories; (2) simplifies die-construction with standardized retainers; (3) permits production of many different parts from only one die; and (4) reduces press "down time" for replacements.

R-B standard punches and dies are stocked for immediate delivery. Punches and dies of special sizes, shapes and materials are made promptly to your specifications.

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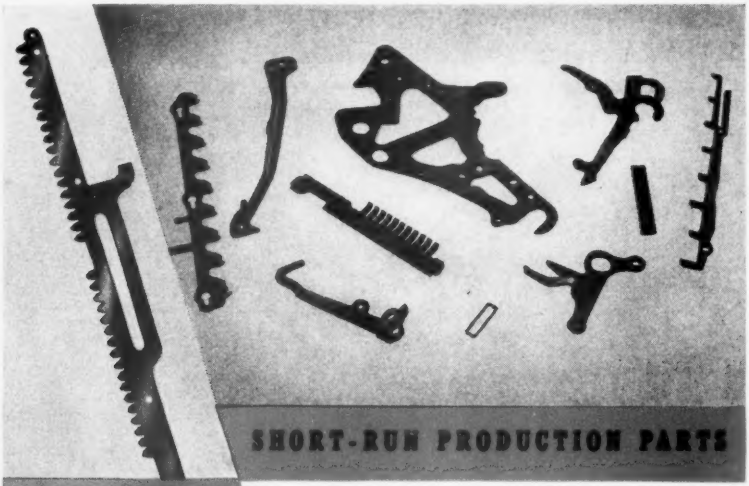
ALLITE DIES CAST OF ZINC ALLOY • JIGS • FIXTURES



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by LAMINA

This is a master part for business machines. The stock is .050" thick and the part was hardened and ground on all surfaces . . . holes and tooth forms included. Customer reports that all dimensions are perfect with the exception of .0001" variation in the spacing of four teeth which is well within limits.

When production quantities do not warrant conventional stamping and forming tools, Lamina will design and make temporary tooling and produce the parts for you. Parts produced by this method can be held to any specified tolerances (as close as .0001" when required) yet are surprisingly low in cost. Whether your small quantity parts are for experimental work, replacement or any other purpose, it will pay you to have Lamina quote on them.

Producing master parts for business machines, cameras, instruments and many other precision products is a regular service at Lamina, too. The consistent high quality maintained in this exacting work has led many leading companies to single out Lamina as their regular source. The master part shown at the left is typical of the work that has built this confidence. **Lamina Dies & Tools, Inc., 14925 W. Eleven Mile Road, Berkley, Mich.**

DESCRIPTIVE BULLETIN

This colorful bulletin illustrates Lamina's unusual facilities and fully describes our range of products and services. Included is full description of the Lamina Guide-Pin Bushing—hardened steel with bronze plated wearing surface—that is eliminating press down time in shops from coast to coast. Send for your copy, there is no obligation.

Lamina DIES AND TOOLS

LAMINA